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**STAR**
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**AERONAUTICS**

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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Includes aircraft handling qualities; piloting; flight controls; and autopilots.

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Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

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## ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

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Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

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Includes spacecraft thermal and environmental control; and attitude control.

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**20 SPACECRAFT PROPULSION AND POWER 1782**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

## CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.


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## ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics.*


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Includes vacuum technology; control engineering; display engineering; and cryogenics.

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**47 METEOROLOGY AND CLIMATOLOGY** 1849

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Includes biological, dynamic and physical oceanography; and marine resources.

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Includes exobiology; and extraterrestrial life.

## MATHEMATICAL AND COMPUTER SCIENCES

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Includes topology and number theory.

## PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering.*

**70 PHYSICS (GENERAL)** **1897**
For geophysics see *46 Geophysics.* For astrophysics see *90 Astrophysics.* For solar physics see *92 Solar Physics.*

**71 ACOUSTICS** **1898**
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

**72 ATOMIC AND MOLECULAR PHYSICS** **1901**
Includes atomic structure and molecular spectra.

**73 NUCLEAR AND HIGH-ENERGY PHYSICS** **1903**
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

**74 OPTICS** **1904**
Includes light phenomena.

**75 PLASMA PHYSICS** **1909**
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

**76 SOLID-STATE PHYSICS** **1912**
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

**77 THERMODYNAMICS AND STATISTICAL PHYSICS** **1916**
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

## SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

**80 SOCIAL SCIENCES (GENERAL)** **1917**
Includes educational matters.

**81 ADMINISTRATION AND MANAGEMENT** **1917**
Includes management planning and research.

**82 DOCUMENTATION AND INFORMATION SCIENCE** 1918
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

**83 ECONOMICS AND COST ANALYSIS** 1920
Includes cost effectiveness studies.

**84 LAW AND POLITICAL SCIENCE** 1920
Includes space law; international law; international cooperation; and patent policy.

**85 URBAN TECHNOLOGY AND TRANSPORTATION** 1921
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

## SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

**88 SPACE SCIENCES (GENERAL)** 1921

**89 ASTRONOMY** 1921
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

**90 ASTROPHYSICS** 1922
Includes cosmology; and interstellar and interplanetary gases and dust.

**91 LUNAR AND PLANETARY EXPLORATION** 1922
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

**92 SOLAR PHYSICS** 1923
Includes solar activity, solar flares, solar radiation and sunspots.

**93 SPACE RADIATION** N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

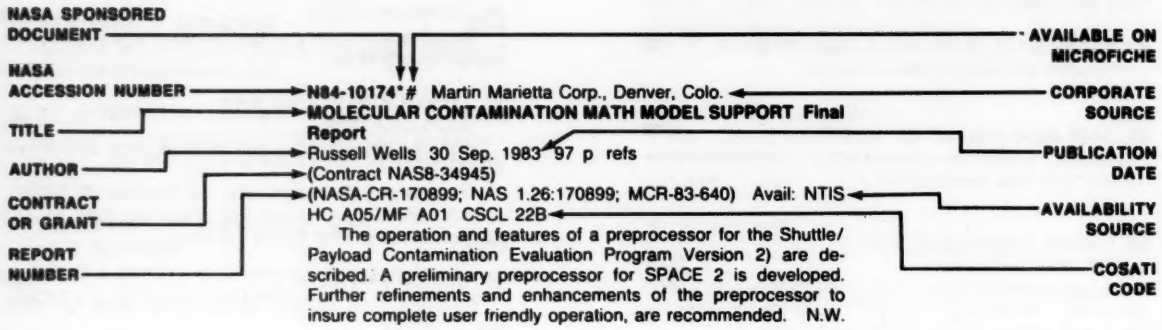
## GENERAL

**99 GENERAL** N.A.

**Note: N.A. means that no abstracts were assigned to this category for this issue.**

SUBJECT INDEX ..... I-1
PERSONAL AUTHOR INDEX ..... I-59
CORPORATE SOURCE INDEX ..... I-67
CONTRACT NUMBER INDEX ..... I-79
REPORT/ACCESSION NUMBER INDEX ..... I-83

# TYPICAL CITATION AND ABSTRACT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N84-10174*# Martin Marietta Corp., Denver, Colo.
MOLECULAR CONTAMINATION MATH MODEL SUPPORT Final Report
Russell Wells 30 Sep. 1983 97 p refs
(Contract NAS8-34945)
(NASA-CR-170899; NAS 1.26:170899; MCR-83-640) Avail: NTIS
HC A05/MF A01 CSCL 22B
The operation and features of a preprocessor for the Shuttle/ Payload Contamination Evaluation Program Version 2) are described. A preliminary preprocessor for SPACE 2 is developed. Further refinements and enhancements of the preprocessor to insure complete user friendly operation, are recommended. N.W.

VOLUME 22 NUMBER 12/JUNE 23, 1984

# Scientific and Technical Aerospace Reports

*A Semimonthly Publication of the National Aeronautics and Space Administration*

## 01 AERONAUTICS (GENERAL)

**N84-21492*** National Aeronautics and Space Administration, Washington, D. C.
**AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 172**
Mar. 1984 113 p
(NASA-SP-7037(172); NAS 1.21:7037(172)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 409 reports, articles and other documents introduced into the NASA scientific and technical information system in February 1984. Author

**N84-21493#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**AGARD HIGHLIGHTS**
Loughton, England Mar. 1983 44 p
(AGARD-Highlights-83/1) Avail: NTIS HC A03/MF A01

The 30th anniversary of AGARD was commemorated. A special issue of AGARD highlights is presented. A historical background and AGARD's progress in aeronautic, combustion, and weapon system programs, as NATO's research subgroup, are outlined. A chronology of important historical AGARD events from 1952 to 1982 is included. E.A.K.

**N84-21494#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**AGARD HIGHLIGHTS, SEPTEMBER 1983**
Loughton, England Aug. 1983 20 p
(AGARD-Highlights-83/2) Avail: NTIS HC A02/MF A01

Included are articles by the director, on the award of the von Karman medal for 1983, flight mechanics and the calendar of meetings for 1984. For individual titles, see N84-21495 through N84-21495.

**N84-21495#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**REPORT BY THE CHAIRMAN OF THE FLIGHT MECHANICS PANEL** **c05**
S. R. M. Sinclair (National Aeronautical Establishment, Ottawa, Ontario) *In its* AGARD Highlights, Sep. 1983 Aug. 1983 p 5-11 (For primary document see N84-21494 12-01)
Avail: NTIS HC A02/MF A01

Continued need for airborne simulation until the role of motion cueing in critical tasks is defined well enough to allow extrapolation from ground simulation with little or no risk was stressed. As aircraft and simulators become increasingly complex, the requirement for airborne simulation becomes critical in developing and evaluating flight control systems and closed-loop systems performance, handling qualities in critical tasks and pre-flight familiarization and check-out. B.G.

**N84-21496#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**AGARD HIGHLIGHTS, SEPTEMBER 1982**
London Aug. 1982 16 p refs
(AGARD-Highlights-82/2) Avail: NTIS HC A02/MF A01

Included are articles on the outgoing chairman of AGARD and the introduction of the new chairman; the winner of the von Karman medal for 1982, corrosion tests, and an obituary for E.H. Hermann Schlicting. For individual titles, see N84-21497 through N84-21497.

**N84-21497#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**THE CORROSION-FATIGUE COOPERATIVE TESTING PROGRAMME** **c26**
Henri P. vanLeeuwen *In its* AGARD Highlights, Sep. 1982 Aug. 1982 p 6-7 refs (For primary document see N84-21496 12-01)
Avail: NTIS HC A02/MF A01

Aircraft in service are exposed to cyclic loads and to chemical attack. Aircraft designers can draw on the results of enormous amounts of research and development in the fields of fatigue and corrosion. Test results in fatigue, creep and corrosion are usually fraught with an annoying amount of scatter of a somewhat unclear origin. The effectiveness of sharing between laboratories and investigation of a size prohibitive for its execution at a single laboratory was assessed. B.G.

**N84-21498#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**AGARD HIGHLIGHTS, MARCH 1984**
Loughton, England Mar. 1984 67 p ref In ENGLISH and FRENCH
(AGARD-Highlights-84/1) Avail: NTIS HC A04/MF A01

Progress made in AGARD programs were reported. Some topics discussed include: fluid dynamics; aerospace research and technology in Germany; aerospace industry; missile systems simulation; military viewpoint on aircraft structural integrity. For individual titles, see N84-21499 through N84-21503.

**N84-21499#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**REPORT BY THE CHAIRMAN OF THE FLUID DYNAMICS PANEL** **c34**
B. Monnerie (ONERA, Paris) *In its* AGARD Highlights, Mar. 1984 Mar. 1984 p 5-15 In FRENCH (For primary document see N84-21498 12-01)
Avail: NTIS HC A04/MF A01

Problems related to fluid dynamics and flow visualization in the aerospace industry are discussed. It is anticipated that computers and wind tunnels will remain tools in aeronautical design, and the accuracy of their performance predictions depends on: (1) progress in numerical analysis; (2) programs in turbulence modeling; (3) accuracy of wind tunnel measurements; (4) knowledge of flow details; (5) computer power. E.A.K.

**N84-21500#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**AEROSPACE RESEARCH AND TECHNOLOGY IN GERMANY** **c81**
Hermann L. Jordan (DFVLR) *In its* AGARD Highlights, Mar. 1984 Mar. 1984 p 21-32 (For primary document see N84-21498 12-01)
Avail: NTIS HC A04/MF A01

Highlights of aeronautical research in Germany are outlined. A history of the German aerospace industry is presented. Key research areas are: fluid dynamics, aerodynamics; flight mechanics, guidance and control; structures and materials; propulsion and energetics; target recognition, reconnaissance; and aeromedicine. E.A.K.

**N84-21501#** Federation of the German Aerospace and Equipment Industry (West Germany).
**THE AEROSPACE INDUSTRY IN GERMANY: TODAY AND TOMORROW**
Ernst-Georg Pantel (MMB G.m.b.H.) *In* AGARD AGARD Highlights, Mar. 1984 Mar. 1984 p 33-39 (For primary document see N84-21498 12-01)
Avail: NTIS HC A04/MF A01

Progress in the German aerospace industry was assessed. The state of the art and future developments are outlined. The design and production of the following future equipment and hardware is presented: combat aircrafts; missiles and weapons; helicopters, transport aircrafts; and spacecrafts. E.A.K.

**N84-21502#** Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
**MISSILE SYSTEM: SIMULATION AND VALIDATION** **c15**
Roland Gauggel *In* AGARD AGARD Highlights, Mar. 1984 Mar. 1984 p 40-53 ref (For primary document see N84-21498 12-01)
Avail: NTIS HC A04/MF A01

Simulation methods, simulation languages, and the objectives of missile simulation are outlined. E.A.K.

**N84-21503#** Royal Air Force, Farnborough (England).
**AN RAF VIEWPOINT ON AIRCRAFT STRUCTURAL INTEGRITY** **c05**
Alec Morris *In* AGARD AGARD Highlights, Mar. 1984 Mar. 1984 p 59-66 (For primary document see N84-21498 12-01)
Avail: NTIS HC A04/MF A01

The structural integrity problems of the RAF were discussed. The changes of materials and design concepts are outlined. The use of data base equipment for structural design methods, materials behavior, effects of operational usage is delineated. The cooperation between design authorities and operators is emphasized. E.A.K.

**N84-21504#** Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
**CLEANING COMPOUND EFFICIENCY; TEST METHOD FOR AIRCRAFT SURFACE CLEANERS Progress Report**
K. G. Clark 22 Nov. 1983 18 p
(F61-542)
(AD-A138515; NADC-84002-60) Avail: NTIS HC A02/MF A01 CSCL 11/1

A reproducible, quantitative method for determining cleaning efficiency is described. The method uses a camouflage paint substrate (gloss = 9.0) and various aircraft fluids mixed with carbon black. Tenacity of the soil, from most difficult to clean to easiest to clean, was as follows: MIL-H-5606, MIL-S-81087, MIL-L-23699, MIL-H-83282, Coolanol 25R. Author (GRA)

**N84-21505#** Information Spectrum, Inc., Arlington, Va.
**ENHANCEMENT AND VERIFICATION OF THE NAVY CASEE (COMPREHENSIVE AIRCRAFT SUPPORT EFFECTIVENESS EVALUATION) MODEL (CALENDAR YEAR 1983 TASK) Final Technical Report, 12 Dec. 1982 - 12 Dec. 1983**
12 Dec. 1983 33 p
(Contract N60921-82-C-0020)
(AD-A138516; ISI-V-1891-02) Avail: NTIS HC A03/MF A01 CSCL 09/2

In order to respond to evolving fleet requirements and procedures in operating systems and maintenance reporting systems, the Navy Comprehensive Aircraft Support Effectiveness and Evaluation (CASEE) Model required periodic updating and restructuring. The CASEE enhancements described in this report resulted from basic needs within the CASEE users community to have CASEE reflect the changing criteria that are instrumental in analyzing fleet operating and maintenance policies. Enhancements were selected and implemented based on projecting utility in CASEE applications. A prototype data base, consisting of S-3A aircraft reliability and maintainability data, was generated for use in installing and bench marking CASEE Version 5 at required user's facilities. A new CASEE version, Version 6, was developed as an initial attempt to integrate the V/STOL multiship operational aspects of Version 4 with the maintenance generation speedup routine and the Subsystem Capability Impact Reporting (SCIR) system analytical capability of Version 5. Program Listings incorporating the integration of this logic were generated. It is recommended that further efforts be expended to refine existing enhancements and include additional enhancement candidates. GRA

**N84-21506#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**ACTA AERONAUTICA ET ASTRONAUTICA SINICA (SELECTED ARTICLES**
H. Y. Li, S. C. Lo, M. Yan, K. H. Chang, and S. N. Li 30 Jan. 1984 145 p Transl. into ENGLISH from Hang Kong Xuebao (China), v. 4, no. 2, Jun. 1983 p 1-38; 73-111
(AD-A138531; FTD-ID(RS)T-1752-83) Avail: NTIS HC A07/MF A01 CSCL 01/3

The following topics were discussed: fatigue crack propagation of metals and alloys; finite difference computation of wave drag; finite element models; buzz in axisymmetric supersonic inlets; prediction methods for transonic turbines and curing and mechanical properties of composite materials. B.G.

# 02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

**N84-21507#** George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
**EFFECTS OF A POROUS PLUG ON ORIFICE INDUCED STATIC PRESSURE ERROR M.S. Thesis**
Elizabeth Baldwin Plentovich Feb. 1984 135 p refs
Avail: NTIS HC A07/MF A01

A flat plate model was investigated in the Langley 7 foot- by 10-foot high speed wind tunnel at Mach numbers from 0.40 to 0.72 to extend the current orifice induced pressure error data base. It was concluded that the error induced by a conventional orifice at high Reynolds numbers could not be neglected: however, if a piece of porous metal was pressed in fitted into the orifice, the error was virtually eliminated. A second investigation was conducted in the Langley 0.3 meter transonic cryogenic tunnel on a NACA 65(1) 213 airfoil at Mach numbers of 0.60 to 0.80 and at Reynolds numbers (based on chord) from 6 million to 40 million. Comparison of the porous plug orifice and two conventional orifices (0.102 cm and (0.025 cm) shows that the porous plug orifices have a response time nearly the same as the 0.025 cm orifices and do not effect pressures measured directly downstream. Downstream of the shock, the orifice was not critical. The orifice pressure data obtained did not behave as expected and produced results that are not yet explained. A.R.H.

**N84-21508#** George Washington Univ., Washington, D.C. School of Engineering and Applied Science.

**A COMPUTATIONAL METHOD FOR PREDICTING THE EFFECTS OF VARYING REYNOLDS NUMBER AND DYNAMIC PRESSURE ON FLEXIBLE WINGS AT TRANSONIC SPEEDS M.S. Thesis**
Richard Lawson Campbell Jan. 1984 73 p refs
Avail: NTIS HC A04/MF A01

A three dimensional, small perturbation, transonic potential flow code with interactive boundary layer was combined with a linear finite element structural analysis program to form TAPS, a transonic aeroelastic program system. Arranged in modular fashion so that the different aerodynamic or structural codes may be used without extensive modifications to the rest of the system, the aerodynamic-structural interaction is fully automated. A statically loaded wing was investigated to verify the structural modeling method; wing pressures and deflections using TAPS were then compared with results from previous wind tunnel tests. The structural modeling method used in TAPS accurately predicted the measuring wing deflections under both air and applied point loads. Wing pressure levels were also predicted fairly well with good correlation (except near shocks) between theortical and experimental increments in pressure coefficients caused by changing Reynolds number and dynamic pressure. The aerodynamic code did not, in general, predict shock locations very well. For one of the test cases, the aeroelastic effects were much more significant than the effects of viscosity on the predicted pressure distributions. A.R.H.

**N84-21509#** Texas A&M Univ., College Station.
**MACH NUMBER CORRELATION FOR A TWO-DIMENSIONAL HELICOPTER ROTOR-BLADE ANALYSIS IN THE TIP REGION M.S. Thesis**
John Joseph Schillings Dec. 1983 229 p refs
Avail: NTIS HC A11/MF A01

A correlation procedure was developed whereby two-dimensional analysis methods can be utilized to predict chordwise pressure distributions in the tip region of a helicopter blade. Blade surface pressures obtained using a two-dimensional transonic analysis method, TRANDES, were compared to measured data from an AH-1G helicopter. Based on the results of these correlations, a correction to the two-dimensional normal mach number was developed as a function of the transonic thickness similarity parameter and blade azimuth. The correlation method, which is applicable in regions of supercritical flow, can be used with existing lifting line or lifting surface performances analysis. Author

**N84-21510#** Texas A&M Univ., College Station.
**IDENTIFICATION OF AIRFOIL CHARACTERISTICS FOR OPTIMUM WIND TURBINE PERFORMANCE M.S. Thesis**
Leonard Scott Miller Dec. 1983 67 p refs
Avail: NTIS HC A04/MF A01

Momentum strip theory and a performance optimization routine were used to determine the relationship between airfoil lift and drag characteristics and turbine performance. High lift and low drag was found to improve, respectively, the low and high tip speed ratio power output of the turbine. A study using the NASA 63 series family shows that airfoils with 12 to 15% thickness should generate good performance over a broad range of tip speed ratios. A.R.H.

**N84-21511*#** Complere, Inc., Palo Alto, Calif.
**APPLICATION OF LASER VELOCIMETRY TO UNSTEADY FLOWS IN LARGE SCALE HIGH SPEED TUNNELS**
F. K. Owen Jul. 1983 16 p refs
(Contract NAS2-11080)
(NASA-CR-166575; NAS 1.26:166575) Avail: NTIS HC A02/MF A01 CSCL 01A

Flowfield measurements obtained in several large scale, high speed facilities are presented. Sampling bias and seeding problems are addressed and solutions are outlined. The laser velocimeter systems and data reduction procedures which were used in the experiments are also described. The work demonstrated the potential of the laser velocimeter for applications in other than closely controlled, smallscale laboratory situations. Author

**N84-21512#** Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Aerodynamics.
**DESIGN OF SINGLE COMPONENT AIRFOILS USING AN INVERSE BOUNDARY ELEMENT METHOD**
Erkki Soinne 1983 131 p
(Rept-83-A2-Ser-A; ISSN-0358-2620; ISBN-951-753-158-3) Avail: NTIS HC A07/MF A01

An inverse boundary element formulation is presented for potential flow for the determination of contour coordinates of a single component airfoil from a prescribed velocity distribution. The airfoil boundary is replaced by a closed polygon consisting of straight-line elements with nodes at the end points and a linearly varying vortex density. Discretization of the stream function integral equation governing the flow around an airfoil leads to an algebraic set of equations. This is solved in an iterative manner: node coordinates are sought which satisfy the set of equations when the velocities at the nodes are prescribed. For practical calculations the computer program INVAIR is utilized. As input data for the program, a prescribed velocity distribution with corresponding angle of attack and an initial airfoil are given. The program has a routine for distribution initial nodes at equidistant values of a contour curvature function for ease of data input. The program, written in FORTRAN-20, was run on a DEC-20 computer. Author

**N84-21513*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**TRANSONIC CALCULATION OF AIRFOIL STABILITY AND RESPONSE WITH ACTIVE CONTROLS**
John T. Batina and T. Y. Ynag (Purdue Univ., Lafayette, Ind.) Mar. 1984 13 p refs
(NASA-TM-85770; NAS 1.15:85770) Avail: NTIS HC A02/MF A01 CSCL 01A

Transonic aeroelastic stability and response analyses are performed for the MBB A-3 supercritical airfoil. Three degrees of freedom are considered: plunge, pitch, and aileron pitch. The control of airfoil stability and response in transonic flow are studied. Stability analyses are performed using a Pade aeroelastic model based on the use of LTRAN2-NLR transonic small disturbance finite difference computer code. Response analyses are performed by coupling the structural equations of motion to the unsteady aerodynamic forces of LTRAN2-NLR. The focus is on transonic time marching transient response solutions using modal identification to determine stability. Frequency and damping of these modes are directly compared in the complex s-plane with Pade model eigenvalues. Transonic stability and response characteristics of 2-D airfoils are discussed and comparisons are made. Application of the Pade aeroelastic model and time marching analyses to flutter suppression using active controls is demonstrated. Author

**N84-21514*#** Texas A&M Univ., College Station. College of Engineering.
**INVERSE TRANSONIC AIRFOIL DESIGN METHODS INCLUDING BOUNDARY LAYER AND VISCOUS INTERACTION EFFECTS Semiannual Progress Report, 1 Sep. 1983 - 31 Jan. 1984**
Leland A. Carlson Apr. 1984 36 p refs
(Grant NsG-1174)
(NASA-CR-173449; NAS 1.26:173449; TAMRF-3224-84-01) Avail: NTIS HC A03/MF A01 CSCL 01A

This report covers the period 1 September 1983 to 31 January 1984. The primary task during this reporting period was the continued development of the massive separation model and computer code (SKANSEP). In particular, detailed investigations were conducted with the boundary layer displacement surface correction technique discovered near the end of the last reporting period. This report will present detailed results using this technique and show comparisons with experimental data. Author

**N84-21515*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**DEMONSTRATION OF THE COAST-DOWN TECHNIQUE FOR DETERMINING TRAIN RESISTANCES Final Report**
Bain Dayman Oct. 1983 67 p refs
(NASA-CR-173468; JPL-Pub-83-85; NAS 1.26:173468) Avail:

NTIS HC A04/MF A01 CSCL 01A

Full-scale measurement or validation of the various factors of train running resistance is an essential step in decreasing train energy consumption. Such a measurement capability would enable railroads to evaluate the cost benefits of operational and train consistent configuration changes, and new vehicle and truck designs for decreasing aerodynamic drag and rolling resistance. A decrease in the rolling resistance affects more than just a decrease in energy consumption; it also will result in decreased mechanical wear, hence less wheel and rail maintenance and replacement costs. A demonstration of a simple coast-down technique (based on computer-reduction of distance history) was accomplished using specially configured trains on main line rail provided by the Atchison, Topeka and Sante Fe Railway Co. This demonstration test shows that this distance-history coast-down technique for trains is easy to execute in the field. The total running resistance history was accurately determined and subsequently separated into rolling resistance (mechanical friction) and aerodynamic drag. B.W.

**N84-21516*#** Boeing Military Airplane Development, Seattle, Wash. Propulsion Technology.

**INLET FLOWFIELD INVESTIGATION. PART 2: COMPUTATION OF THE FLOW ABOUT A SUPERCRUISE FOREBODY AT SUPERSONIC SPEEDS Final Report**

G. C. Paynter, V. Salemann, and E. E. I. Strom Apr. 1984 143 p refs

(Contract NAS1-16612)

(NASA-CR-172315; NAS 1.26:172315; D180-27939-2) Avail: NTIS HC A07/MF A01 CSCL 01A

A numerical procedure which solves the parabolized Navier-Stokes (PNS) equations on a body fitted mesh was used to compute the flow about the forebody of an advanced tactical supercruise fighter configuration in an effort to explore the use of a PNS method for design of supersonic cruise forebody geometries. Forebody flow fields were computed at Mach numbers of 1.5, 2.0, and 2.5, and at angles-of-attack of 0 deg, 4 deg, and 8 deg. at each Mach number. Computed results are presented at several body stations and include contour plots of Mach number, total pressure, upwash angle, sidewash angle and cross-plane velocity. The computational analysis procedure was found reliable for evaluating forebody flow fields of advanced aircraft configurations for flight conditions where the vortex shed from the wing leading edge is not a dominant flow phenomenon. Static pressure distributions and boundary layer profiles on the forebody and wing were surveyed in a wind tunnel test, and the analytical results are compared to the data. The current status of the parabolized flow flow field code is described along with desirable improvements in the code. Author

**N84-21517*#** Iowa Univ., Iowa City.

**STUDY OF LARGE-SCALE MIXING IN DEVELOPING WAKES BEHIND STREAMLINED BODIES Final Technical Report, 1 Jul. 1981 - 31 Dec. 1983**

B. R. Ramaprian, Krishna Prasad L. Kalale, Srba Jovic, and Sumanth Kaushik Apr. 1984 28 p refs

(Grant NAG2-110)

(NASA-CR-173478; NAS 1.26:173478) Avail: NTIS HC A03/MF A01 CSCL 01A

Heat-tagging and conditional sampling techniques were used to study the large scale mixing process in the developing wake behind a streamlined body. The results were used to understand the manner in which the large eddy length scale evolves from a value appropriate to a boundary layer to that appropriate to the asymptotic far-wake. Author

**N84-21518#** Sandia Labs., Albuquerque, N. Mex. Parachute Systems Div.

**DEVELOPMENT OF THE PARACHUTE RECOVERY SYSTEM FOR THE LBRV-2 REENTRY VEHICLE**

William B. Pepper Oct. 1983 15 p refs Presented at the 8th AIAA Conf. on Aerodyn. Decelerator and Balloon Technol., Hyannis, Mass., 2 Apr. 1983

(Contract DE-AC04-76DP-00789)

(DE84-001540; SAND-83-0432C; CONF-8304129-2) Avail: NTIS HC A02/MF A01

A 6.44-ft in diameter ribbon parachute with no reefing was developed for recovery for the 130-lb Large Ballistic Reentry Veicle (LBRV)-2 reentry nose cone. The results at velocities of 600 to 875 ft per s with corresponding dynamic pressures of 340 to 766 lb per ft are presented. DOE

**N84-21519#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.

**THE EXISTENCE OF KARMAN VORTEX STREETS OF UNEQUAL VORTEX STRENGTHS AND POSSIBLE FORMS OF WAKE FLOW BEHIND BLUFF BODIES**

Yi Chuin Sun Sep. 1983 38 p refs

(DFVLR-FB-83-33) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 14

Using stability analysis and basic theory of the necessary conservation of circulation for a steady or periodic-steady flow it is shown that a double-row vortex street with unequal vortex strengths must be basically unstable. The periodic wake flow behind a bluff body can thus consist of either a conventional Karman vortex street or a heterogeneous vortex zone. In both cases a relatively simple criterion for the determination of separation points can be derived. Author (ESA)

**N84-21520#** Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

**INITIAL EXPERIMENTS ON PROFILE VORTEX INTERACTION**

G. E. A. Meier, R. Timm, and F. Becker Jun. 1983 45 p refs (MPIS-6/1983; ISSN-0436-1199) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9,75

Aeroacoustic sound generation of helicopter rotor vortex interaction was studied using a transonic duct. Vortices were generated upstream of a NACA 0012 profile and the pressure field was recorded by transducers. The pressure signals were stored digitally and processed to get spectra and correlations. The density fields were recorded interferometrically. An automatic interferogram analysis technique was used to evaluate densities, pressures and vortex traces from the interferograms. Results show that a separation bubble is formed at the leading edge of the wing when the vortex passes over the profile. The complicated flow at the boundary of the profile is one of the keys to vortex profile interaction. Author (ESA)

**N84-21521#** National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Dept.

**APPLICATION OF COMPUTATIONAL PROCEDURES IN AERODYNAMIC DESIGN**

J. W. Slooff 24 Feb. 1983 26 p refs Presented at AGARD-FDP-VKI Special Course on Subsonic/Transonic Aerodyn. Interference for Aircraft, Rhode-Saint-Genese, Belgium and Dayton, Ohio, May 1983

(NLR-MP-83012-U) Avail: NTIS HC A03/MF A01

Applications of computational methods in aerodynamic design problems involving interference, including subsonic wing-body, string support, pylon-nacelle and pylon-store interference, high-lift devices, induced drag minimization through constrained optimization in the Treftz-plane, and transonic wing-fuselage design and analysis are discussed. Optimal use of aerodynamic software in analyses and design requiring an integrated systems approach is considered. Author (ESA)

**N84-21522#** National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

**COMPUTATIONAL VORTEX FLOW AERODYNAMICS**

H. W. M. Hoeijmakers 15 Mar. 1983 38 p refs Presented at AGARD Fluid Dyn. Panel Symp. on Aerodyn. of Vortical Type Flows in Three Dimensions, Rotterdam, 25-28 Apr. 1983 Sponsored by Directorate of Material Royal Netherlands Air Force (RNLAF)

(NLR-MP-83017-U) Avail: NTIS HC A03/MF A01

Computational methods for the determination of the characteris-

tics of vortical type flows occurring in aircraft aerodynamics are reviewed. Panel methods for computing the downstream development of vortex wakes and methods for computing the characteristics of configurations with leading-edge and strake vortices are discussed. Prospects for improving computational methods, and developments are identified. Author (ESA)

**N84-21523#** National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

**AN INTERACTIVE SYSTEM FOR THE ANALYSIS AND CONSTRAINED MINIMIZATION OF INDUCED DRAG OF AIRCRAFT CONFIGURATIONS (SAMID)**

R. F. vandenDam Dec. 1982 14 p refs Presented at the 21st AIAA Aerospace Sci. Meeting, Reno, Nev., 10-13 Jan. 1983

(Contract NIVR-1945)

(NLR-MP-82057-U) Avail: NTIS HC A02/MF A01

An interactive computer program system for induced-drag analysis, optimization and configuration design was developed. The program system employs subsonic far field analysis, and mathematical formulations of the constrained optimization problems based on calculus of variations. The analysis and optimization technique, utilizing panel method technology with piecewise quadratically varying bound-circulation, is fast, numerically stable and easy to use, and is suitable for interactive design when rapid configuration trade-offs must be made. Author (ESA)

**N84-21524#** National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

**COMPUTATIONAL METHODS FOR SUBSONIC AND TRANSONIC AERODYNAMIC DESIGN**

J. W. Slooff 20 Jan. 1983 43 p refs Presented at AGARD-FDP-VKI Special Course on Subsonic/Transonic Aerodyn. Interference for Aircraft, Rhode-Saint-Genese, Belgium and Dayton, Ohio, May 1983

(AD-B079994; NLR-MP-83006-U) Avail: NTIS HC A03/MF A01 CSCL 01/2

Computational methods for finding the detailed shape of parts of aircraft configurations of which the gross geometric characteristics were determined in a preliminary, overall design process, and that have to meet given aerodynamic requirements, are reviewed. Methods for solving the inverse problem of aerodynamics and approaches using optimization techniques are discussed. Methods limited to subsonic flow utilizing panel method technology and methods based on finite difference/volume formulations for compressible, transonic flow are covered. Author (ESA)

# 03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

**N84-21525#** National Transportation Safety Board, Washington, D. C.

**AIRCRAFT ACCIDENT REPORT: SIERRA PACIFIC AIRLINES, DHC-6-300, N361V, HAILEY, IDAHO, FEBRUARY 15, 1983**

6 Mar. 1984 53 p

(PB84-910403; NTSB/AAR-84/03) Avail: NTIS HC A04/MF A01 CSCL 01C

About 1100 Mountain Standard Time (MST), on February 15, 1983, a Sierra Pacific Airlines DHC-6, operating as Transwestern Flight 868, a regularly scheduled commuter flight from Boise, Idaho, crashed during its final approach to a landing on runway 31, 1.7 miles south of the Friedman Memorial Airport at Hailey, Idaho. The National Transportation Safety Board determines that the probable cause of the accident was the inflight loss of elevator control following separation of the control rod from the torque tube at a connection where the company's maintenance department had used a nonstandard, unsecured bolt, which the company's inspection department had failed to detect. Contributing to the accident was the company's failure to maintain the separation of maintenance and inspection functions required by the maintenance program approved by the Federal Aviation Administration, (FAA) and the failure of the FAA to detect the company's deviation from approved maintenance procedures during surveillance inspection. M.A.C.

**N84-21526#** General Accounting Office, Washington, D. C. Resources Community Economic Div.

**SAFETY STANDARDS ON SMALL PASSENGER AIRCRAFT WITH NINE OR FEWER SEATS ARE SIGNIFICANTLY LESS STRINGENT THAN ON LARGER AIRCRAFT**

4 Jan. 1984 45 p refs

(PB84-142033; GAO/RCED-84-2; B-197116) Avail: NTIS HC A03/MF A01 CSCL 01C

Approximately 44 percent of the commuter fleet and 90 percent of the air taxi fleet consists of small aircraft. The GAO found that the airworthiness standards and operating rules for the small aircraft used by air carriers are significantly less stringent than those for larger aircraft used for the same purpose. It is recommended that the Secretary of Transportation and the Administrator of FAA identify the standards and rules that are significantly less stringent for small aircraft; prepare cost/benefit estimates for possible upgrades of those standards, working with operators and manufacturers; and implement the alternatives that are feasible and cost beneficial. GRA

# 04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

**N84-21527#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**GLOBAL POSITIONING SYSTEM SATELLITE SELECTION EVALUATION FOR AIDED INERTIAL NAVIGATION M.S. Thesis**

P. M. Vaccaro Dec. 1983 212 p

(AD-A138070; AFIT/GE/EE/83D-67) Avail: NTIS HC A10/MF A01 CSCL 17/7

The navigation performance of the geometric dilution of precision (GDOP) GPS satellite criterion versus an alternate GPS satellite selection criterion for an integrated GPS/INS Navigator in a jamming environment is tested and analyzed. The theoretical development of GDOP and GDOP based satellite selection criterion are reviewed. From this review a satellite selection criterion known as the cost criterion (which is a combination of noise weighted GDOP and the a priori covariance weighted least squares position error) is selected for performance testing against a GDOP satellite selection criterion. Performance assessment of the two satellite selection criterion is accomplished using a modified version of the integrated GPS/INS (IGI) Computer Simulation. The IGI Simulator is modified to simulate adaptive bandwidth control of the satellite tracking loops, the use of a mull steering antenna, the use of an alternate satellite selection criterion, and the effects due to jammers. The performance assessment is based on simulating a single F-4 close air support mission encountering five different jamming scenarios. GRA

**N84-21528#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**EXTRACTION OF ROTATION INFORMATION FROM A SIMULATED FIBER OPTIC GYRO USING AMPLITUDE MODULATION M.S. Thesis**

D. J. Brett Dec. 1983 84 p

(AD-A138092; AFIT/GE/EE/83D-12) Avail: NTIS

HC A05/MF A01 CSCL 17/7

The purpose of this experiment was to determine feasibility of the amplitude modulated dither technique of extracting rotation information from a fiber optic gyroscope. By varying the amplitude of the modulation appropriately, information can be obtained at points on the output intensity curve that are most sensitive to rotation. These points are also in the most linear region of the curve. A Michelson interferometer is used to simulate a Sagnac interferometer undergoing rotation. A digital control loop processes the information obtained by amplitude modulation and generates a feedback signal to null the path length difference. The feedback signal is monitored while a rotation simulation signal is introduced to the interferometer. The feedback signal tracks the simulation signal at 180 degrees out of phase (negative feedback). The test setup performs as expected to the hardware and operating frequency limits. Author (GRA)

**N84-21529#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**CELESTIAL PATTERN RECOGNITION ALLOWING AUTONOMOUS EARTH-SURFACE OR DEEP-SPACE POSITIONING M.S. Thesis**

E. P. Schempp Dec. 1983 153 p

(AD-A138115; AFIT/GCS/EE/83D-19) Avail: NTIS HC A08/MF A01 CSCL 17/7

This project explores the feasibility of using a small, general digital processor, with an optical sensor and a clock, as a means to autonomously determine location. A stellar pattern-recognition algorithm is presented that determines the identity of any of the navigation stars catalogued in the U.S. Naval Observatory Air Almanac which may be in the sensor's field of view. Appendices describe an iterative method for determining position on the surface of the Earth from celestial observations without using azimuth information, and a mechanism for determining relative position in deep space. GRA

**N84-21530#** Ohio Univ., Athens. Avionics Engineering Center.

**INSTRUMENT LANDING SYSTEM CRITICAL AREA STUDIES Final Report**

R. H. McFarland and J. D. Longworth Nov. 1983 197 p

(Contract DTFA01-82-C-10050)

(AD-A138228; OU/AEC/EER-59-3; DOT/FAA/PM-83/39) Avail: NTIS HC A09/MF A01 CSCL 17/7

Theoretical and experimental studies have been performed to determine the perturbational effects on glide slope and localizer course structures. The effects are those produced by aircraft parked in front of the transmitting antennas. Contours are given which indicate the maximum path irregularity for a particular ILS zone given a specific size aircraft, its location and orientation. From these, critical area designations for particular airdromes can be determined. Special concerns have been given to the effects of the Boeing 747 on the performance of the Cat III, two-frequency localizer and on the 8- and 14- element, single-frequency systems. Also, effects of general aviation type aircraft on the null-reference glide slope have been calculated and measured. GRA

**N84-21531#** Lincoln Lab., Mass. Inst. of Tech., Lexington.

**MODE S SURVEILLANCE NETTING**

J. L. Gertz 4 Nov. 1983 226 p

(Contract DOT-FA72WAI-261)

(AD-A138267; ATC-120; DOT/FAA/PM-83/17) Avail: NTIS HC A11/MF A01 CSCL 17/7

The surveillance performance of a single Mode S Sensor is degraded by several factors, including: poor crossrange accuracy at long range, diffraction-induced azimuth errors, missing or incomplete reports, and extraneous reports. The surveillance netting project reported here sought to overcome these difficulties by employing information from a secondary (and perhaps also a tertiary) sensor. The project was performed to determine what auxiliary information is most useful, how this information could be used for maximum effect, when help should be sought for other sensors, what form this inter-sensor communications should take, and where the netting algorithms should be implemented. It was also planned to include the construction of a real-time netting demonstration system to exercise and test the concepts developed. The central issue in this project was the approach to be used for multi-sensor azimuth determination. In particular, a new form of incremental bilateration, employing a flat Earth model, is shown to be both accurate and bias-resistant. Altitude estimation methods and multi-sensor tracker design are also addressed, with new algorithms developed in each case. Finally, the design of the netting subsystem for a Mode S sensor is presented. Author (GRA)

**N84-21532#** Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.

**AN EVALUATION OF A HONDA ELECTRO GYRO-CATOR LAND NAVIGATION SYSTEM**

S. G. McDaniel Aug. 1983 80 p

(AD-A138283; AD-E950476; DRSMI/RG-83-16-TR) Avail: NTIS HC A05/MF A01 CSCL 17/7

A Honda Electro Gyro-Cator land navigation system was evaluated under laboratory and field conditions to determine land navigation accuracies. Laboratory evaluations determined system characteristics such as static drift, frequency response, phase shift, and input-output characteristics (scale factors, bias, and hysteresis). Field evaluations determined land navigation accuracies of approximately 3.5% RMS error per distance traveled. Author (GRA)

**N84-21533#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**EVALUATION OF INSTRUMENT LANDING SYSTEM DDM (DIFFERENCE IN DEPTH OF MODULATION) CALIBRATION ACCURACIES M.S. Thesis**

D. M. McCollum Dec. 1983 121 p

(AD-A138301; AFIT/GE/EE/83D-43) Avail: NTIS HC A06/MF A01 CSCL 01/4

Instrument landing system (ILS) accuracy is highly dependent upon the accuracy of the test instrumentation used in maintaining it. In an effort to upgrade calibration support to Air Force instrument landing systems, the Air Force Measurement Standards Laboratory requested an independent study be done on modulation factor and DDM accuracies. In this thesis report, ILS accuracy requirements are analyzed along with the accuracy specifications of test instrumentation. The report provides a short tutorial on ILS concepts in chapter 2. In chapter 3, modulation factor and DDM accuracy specifications have been compiled from various source documents. The evaluation, in chapter 4, looks at the adequacy of ILS test instruments and the ILS modulation factor and DDM calibration hierarchies. Based on the decision criteria used, it shows that existing instrumentation cannot adequately support all Categories of ILS. The significant results of the evaluation are summarized in chapter 5 along with the author's recommendations. Author (GRA)

**N84-21534#** National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

**AIRBORNE REAL TIME MULTISENSOR NAVIGATION**

B. vanderMoezel Mar. 1983 24 p refs Presented at 2nd European ROLM Users Group Conf., Wiesbaden, 22-23 Mar. 1983

(AD-B079957; NLR-MP-83013-U) Avail: NTIS HC A02/MF A01 CSCL 17/7

An aircraft navigation system based on multisensor data, from distance measuring equipment, for example, is described. A ROLM 1602 B controls the sensors and performs all necessary calculations to determine position, velocity, and steering command. Positioning accuracy of an aircraft in flight of 30 to 100 m is expected, with the system upgraded to a 4D navigation system, coupled to an electronic flight instrument system. The development of the multisensor positioning part of the system is outlined. Real-time aspects and testing are considered. Author (ESA)

**N84-21535#** Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.

**SIMULATION ANALYSIS AND DERIVATION OF ACCURACY REQUIREMENTS FOR FUTURE TERMINAL AREA NAVIGATION. PART 1: SINGLE AIRCRAFT ANALYSIS Final Report, May 1983**

Manfred Fricke and Andreas Hoermann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 100 p refs Sponsored by Bundesministerium fuer Forschung und Technologie 2 Vol.
(BMFT-FB-W-83-035-Pt-1; ISSN-0170-1339) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21

A Monte Carlo simulation program for terminal maneuvering area simulation (TMASIM) was developed to analyze the impact of navigation system accuracies and additional influences (wind, speed, flight management system) on the delivery time error at a gate. The program models a TMA scenario with a fixed path speed control delay fan system. Analysis of example configurations shows the application possibilities of TMASIM. A final parameter variation leads to the operational accuracy requirements for future navigation systems in the TMA. Author (ESA)

**N84-21536#** Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
**SIMULATION ANALYSIS AND DERIVATION OF ACCURACY REQUIREMENTS FOR FUTURE TERMINAL AREA NAVIGATION. PART 2: MULTI AIRCRAFT ANALYSIS Final Report, May 1983**
Manfred Fricke and Andreas Hoermann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 99 p refs Sponsored Bundesministerium fuer Forschung une Technologie 2 Vol.
(BMFT-FB-W-83-036-Pt-2; ISSN-0170-1339) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20,50

A terminal area maneuver simulation program system TASIMD was developed to analyze the impact of navigation accuracy and other error sources on delivery time error and the number and severity of the occurring separation violations. The TASIMD simulates air traffic operations within a multi aircraft environment, and considers aircraft dynamics. A variable path speed control concept and a fixed path speed control concept were studied. The operational practicability of automated TMA procedures with shared air/ground responsibility was analyzed for a representative future terminal area configured with navigation systems according to the accuracy requirements derived by Monte Carlo simulation. Author (ESA)

# 05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

**N84-21537*#** National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
**THE ROLE OF SIMULATION IN THE DEVELOPMENT AND FLIGHT TEST OF THE HIMAT VEHICLE**
Martha B. Evans and Lawrence J. Schilling Apr. 1984 38 p refs Prepared in cooperation with NASA. Ames Research Center, Moffett Field, Calif.
(NASA-TM-84912; H-1190; NAS 1.15:84912) Avail: NTIS HC A03/MF A01 CSCL 01C

Real time simulations have been essential in the flight test program of the highly maneuverable aircraft technology (HiMAT) remotely piloted research vehicle at NASA Ames Research Center's Dryden Flight Research Facility. The HiMAT project makes extensive use of simulations in design, development, and qualification for flight, pilot training, and flight planning. Four distinct simulations, each with varying amounts of hardware in the loop, were developed for the HiMAT project. The use of simulations in detecting anomalous behavior of the flight software and hardware at the various stages of development, verification, and validation has been the key to flight qualification of the HiMAT vehicle. Author

**N84-21538*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**NUMERICAL ANALYSIS OF A VARIABLE CAMBER ROTOR BLADE AS A LIFT CONTROL DEVICE Final Report**
Alfred O. Awani (Kansas Univ. Center for Research, Inc.) and Robert H. Stroub Apr. 1984 50 p refs
(Contract NCC2-92)
(NASA-CR-173452; NAS 1.26:173452) Avail: NTIS HC A03/MF A01 CSCL 01C

A new rotor configuration called the variable camber rotor was numerically investigated as a lift control device. This rotor differs from a conventional (baseline) rotor only in the blade aft section. In this configuration, the aft section or flap is attached to the forward section by pin joint arrangement, and also connected to the rotor control system for the control of rotor thrust level and vectoring. Pilot action to the flap deflection controls rotor lift and tip path plane tilt. The drag due to flaps is presented and the theoretical result correlated with test data. The assessment of payoff for the variable camber rotor in comparison with conventional (baseline) rotor was examined in hover. The variable camber rotor is shown to increase hover power required by 1.35%, but such a minimal power penalty is not significant enough to be considered a negative result. In forward flight, the control needs of the variable camber rotor were evaluated. Author

**N84-21539*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**WIND-TUNNEL INVESTIGATION OF AN ADVANCED GENERAL AVIATION CANARD CONFIGURATION**
Joseph R. Chambers, Long P. Yip, and Thomas M. Moul Apr. 1984 48 p refs
(NASA-TM-85760; L-15713; NAS 1.15:85760) Avail: NTIS HC A03/MF A01 CSCL 01C

Wind-tunnel tests of a model of an advanced canard configuration designed for general aviation were conducted in the Langley 30- by 60-Foot Tunnel. The objective of the tests was to determine the aerodynamic stability and control characteristics of the configuration for a large range of angles of attack and sideslip at several power conditions. Analysis of the aerodynamic data indicates significant effects of power and of center-of-gravity location. For forward center-of-gravity locations, the configuration had extremely stall-resistant stability and control characteristics. For aft center-of-gravity locations and high-power conditions, the combined effects of increased pitch control and reduced longitudinal stability overpowered the stall resistance provided by the canard, which led to a high-angle-of-attack, deep-stall trim condition. Other aspects of the aerodynamic characteristics studied include the following: flow-visualization study, effect of negative angles of attack, lateral-directional characteristics, and comparison of the stall characteristics with another canard configuration. Author

**N84-21540#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**AN INTRODUCTION TO THE TECHNIQUE OF SINGULAR PERTURBATIONS APPLIED TO PERFORMANCE OPTIMIZATION PROBLEMS IN ATMOSPHERIC FLIGHT MECHANICS**
Dec. 1982 90 p refs
(VTH-LR-374) Avail: NTIS HC A05/MF A01

The transformation of an atmospheric flight mechanics problem to a singular perturbation technique (SPT) problem is discussed, and results from optimal control theory are reiterated. A singularly perturbed nonlinear optimal control problem is described and its formal asymptotic solution is presented. The characteristics of closed loop solutions are examined. The SPT is used to solve the problem of minimum time-to-climb (brachistochrone) and approaches to this problem are surveyed. The restrictions of SPT are outlined, and cases of failure are shown. Author (ESA)

**N84-21541#** National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
**TWO-DIMENSIONAL FLIGHT-PATH RECONSTRUCTION BY MEANS OF SPLINE APPROXIMATION**

M. R. Best 30 Jul. 1982 53 p refs
(Contract NIVR-1943)
(NLR-TR-82075-U) Avail: NTIS HC A04/MF A01

A method to reconstruct the flight path of an aircraft in symmetric, nonsteady flight by representing this path by a set of splines is described. A set of splines is chosen for which the flight test data are best explained in weighted least squares sense. This leads to a large, sparse, nonlinear, overdetermined system, in which the spline coefficients, together with unknown parameters, are the unknowns. Experimental results obtained by processing simulated flight test data compare favorably with the results of the Kalman (square root information) smoother. Author (ESA)

**N84-21495#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**REPORT BY THE CHAIRMAN OF THE FLIGHT MECHANICS PANEL**
S. R. M. Sinclair (National Aeronautical Establishment, Ottawa, Ontario) *In its* AGARD Highlights, Sep. 1983 Aug. 1983 p 5-11 (For primary document see N84-21494 12-01)
Avail: NTIS HC A02/MF A01

**N84-21503#** Royal Air Force, Farnborough (England).
**AN RAF VIEWPOINT ON AIRCRAFT STRUCTURAL INTEGRITY**
Alec Morris *In* AGARD AGARD Highlights, Mar. 1984 Mar. 1984 p 59-66 (For primary document see N84-21498 12-01)
Avail: NTIS HC A04/MF A01

# 06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

**N84-21542*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SIMULATION OF A COCKPIT-DISPLAY CONCEPT FOR EXECUTING A WAKE-VORTEX AVOIDANCE PROCEDURE**
Terence S. Abbott Apr. 1984 37 p refs
(NASA-TP-2300; L-15736; NAS 1.60:2300) Avail: NTIS HC A03/MF A01 CSCL 01D

A piloted simulation study has been undertaken to determine the feasibility and potential benefits of utilizing a forward-looking display to provide information that would enable aircraft to reduce their in-trail separation, and hence increase runway capacity, through the application of multiple glide-path approach techniques. This portion of the study was an initial exploration into a concept in which traffic information was added to a head-up display (HUD) format to allow the pilot to monitor the traffic situation and to self-space on a lead aircraft during a single glide-path approach task. The tests were conducted in a motion-base cockpit simulator configured as a current-generation transport aircraft and include the dynamic effects of the vortices generated by the lead aircraft. The information provided on the HUD included typical aircraft-guidance information and the current and past positions of the lead aircraft. Additionally, the displayed information provided self-separation cues which allowed the pilot to maintain separation on the lead aircraft. The results of this study indicate that the display concept could provide sufficient information to the pilot for traffic monitoring and self-separation. B.W.

**N84-21543#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**GENERAL PURPOSE BUS INTERFACE UNIT (GPBIU) SYSTEM TEST SOFTWARE DESIGN M.S. Thesis**
Rodger A. Lindsey 16 Dec. 1983 112 p
(AD-A138005; AFIT/GCS/EE/84D-64) Avail: NTIS HC A06/MF A01 CSCL 09/2

This project presents high level system requirements, specifications and sample design for testing General Purpose Bus Interface Units (GPBIUs). The GPBIUs are being developed and used by the Air Force Systems Command, Aeronautical Systems Division in direct support of avionics interconnected subsystems (e.g., radar, navigation, target identification, sensors, displays, etc.). An overall system chart is developed and includes four major test systems: Host System Validation; Mode-Test-I (two GPBIUs, one host); Mode-Test-II (two GPBIUs, two hosts); and Off-Line Tests. This project addresses only Mode-Test-I for two GPBIUs and one host. The design for the test system is highly flexible and maintainable and adaptable to changing technologies and requirements as upgraded GPBIUs are developed. Author (GRA)

**N84-21544#** Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio. Materials Engineering Branch.
**REDESIGNED OF T-38 DISPLACEMENT GYROSCOPE PACK Final Report, 30 Jan. 1980 - 3 Jan. 1984**
A. J. Sicard Jan. 1984 18 p
(AD-A138047; DSTZT-83-R-11) Avail: NTIS HC A02/MF A01 CSCL 11/4

In support of the Aerospace Guidance and Metrology Center (AGMC) Ohio, the Air Force Packaging Evaluation Agency redesigned the T-39, 19005 gyroscope displacement pack (TPO-00-077-3218) reducing its cubage by 48% and tare weight by 51%. In addition, fabrication material was reduced by 62% and the new pack design provided for ease of packing and unpacking the gyroscope while maintaining the 15G item fragility protection level. A formal report including drawings, parts breakdown and test data was coordinated with the lead service activity, Oklahoma City Air Logistics Center, (OC-ALC/DSTP). It was recommended that the redesigned pack be considered as a replacement to the current pack in the packing of gyroscope models 2A and 2B.
Author (GRA)

**N84-21545#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**A STUDY OF OPTIMAL COMPUTER NETWORK ARCHITECTURE FOR DIGITAL AVIONICS SYSTEMS M.S. Thesis**
Mesur F. Krilic Dec. 1983 221 p
(AD-A138151; AFIT/GE/EE/83D-36) Avail: NTIS HC A10/MF A01 CSCL 17/2

In this paper, current theoretical considerations in available literature have been used to sort out the essential figures of merit of computer network architectures for digital avionic systems. Fourteen different approaches to the same problem of data multiplexing in avionics systems are analyzed according to the key issues. Conclusions drawn are used to define the optimal computer network architecture for digital avionics. The Self-Managing Multiplex System (SMS) is conceptually designed with respect to the optimal characteristics, along with the discussions of some trade-offs that had to be made. The burst errors self-correcting feature of the broadcast-acknowledgements in the SMS concept seems to deserve some sort of testing in practice. It is recommended that a detailed simulation study should be performed later and a hot bench built up using the latest technologies that exist. Author (GRA)

**N84-21546#** TRW Defense and Space Systems Group, Redondo Beach, Calif.
**MULTIBUS AVIONIC ARCHITECTURE DESIGN STUDY (MAADS) Final Report, 21 Sep. 1981 - 30 Sep. 1983**
B. A. Rich, D. G. Haldeman, J. L. Stautberg, and W. P. Whalen Wright-Patterson AFB, Ohio AFWAL Oct. 1983 140 p
(Contract F33615-81-C-1520; AF Proj. 2003)
(AD-A138226; AFWAL-TR-83-1141) Avail: NTIS HC A07/MF A01 CSCL 17/2

The Multibus Avionic Architecture Design Study (MAADS) evaluated projected avionic requirements for tactical aircraft of the 1990s and defined an architectural approach and design example suitable for use as the baseline for the Avionic System Integration Demonstrator (ASID) System Definition project. The architectural approach is multi-bus in nature including MIL-STD-1553B bus, a high speed bus, and a video bus. System sizing

and timing estimates are provided. Areas for potential future standardization are identified. GRA

**N84-21547#** Army Aviation Research and Development Command, St. Louis, Mo.
**A DUAL DIGITAL TO VIDEO CONVERTER FOR AVIONICS SYMBOLOGY AND MESSAGES**
V. J. Organic and E. A. Karcher Dec. 1983 24 p
(AD-A138383; USAAVRADCOM-TR-83-E-15) Avail: NTIS HC A02/MF A01 CSCL 09/5

A dual digital to video converter (DVC) capable of accepting computer data, storing it in memory, and reformatting for display on a television screen is described in this report. The converter can be used as a general purpose tool for avionics simulation work but is constructed such that it can be flown in an aircraft if desired. Two independent sets of data, such as symbology and printed messages, can be displayed simultaneously on different television monitors or combined on one monitor if desired. The converter has its own video synchronization distribution circuitry or can be synchronized externally. Author (GRA)

# 07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

**N84-21548*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**REAL-TIME HYBRID COMPUTER SIMULATION OF A SMALL TURBOSHAFT ENGINE AND CONTROL SYSTEM**
Clint E. Hart and Leon M. Wenzel Feb. 1984 39 p refs
(NASA-TM-83579; E-1968; NAS 1.15:83579) Avail: NTIS HC A03/MF A01 CSCL 21E

The development of an analytical model of a small turboshaft engine designed for helicopter propulsion systems is described. The model equations were implemented on a hybrid computer system to provide a real time nonlinear simulation of the engine performance over a wide operating range. The real time hybrid simulation of the engine was used to evaluate a microprocessor based digital control module. This digital control module was developed as part of an advanced rotorcraft control program. After tests with the hybrid engine simulation the digital control module was used to control a real engine in an experimental program. A hybrid simulation of the engine's electrical hydromechanical control system was developed. This allowed to vary the fuel flow and torque load inputs to the hybrid engine simulation for simulating transient operation. A steady-state data and the experimental tests are compared. Analytical model equations, analog computer diagrams, and a digital computer flow chart are included. E.A.K.

**N84-21549*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ANALYSIS OF A TOPPING-CYCLE, AIRCRAFT, GAS-TURBINE-ENGINE SYSTEM WHICH USES CRYOGENIC FUEL**
George E. Turney and Laurence H. Fishbach Apr. 1984 23 p refs Presented at the AIAA Aircraft Systems and Operational Meeting, Fort Worth, Tex., 17-19 Oct. 1983
(NASA-TP-2294; E-1735; NAS 1.60:2294) Avail: NTIS HC A02/MF A01 CSCL 21E

A topping-cycle aircraft engine system which uses a cryogenic fuel was investigated. This system consists of a main turboshaft engine that is mechanically coupled (by cross-shafting) to a topping loop, which augments the shaft power output of the system. The thermodynamic performance of the topping-cycle engine was analyzed and compared with that of a reference (conventional) turboshaft engine. For the cycle operating conditions selected, the performance of the topping-cycle engine in terms of brake specific fuel consumption (bsfc) was determined to be about 12 percent better than that of the reference turboshaft engine. Engine weights were estimated for both the topping-cycle engine and the reference turboshaft engine. These estimates were based on a common shaft power output for each engine. Results indicate that the weight of the topping-cycle engine is comparable with that of the reference turboshaft engine. Author

**N84-21550#** National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
**EROSION OF CORROSION RESISTANT COATINGS FOR JET ENGINE COMPRESSORS**
H. J. Kolkman 1 Feb. 1983 8 p refs Presented at the 6th Intern. Conf. on Erosion by Liquid and Solid Impact, Cambridge, England, 4-8 Sep. 1983
(NLR-MP-83010-U) Avail: NTIS HC A02/MF A01

Laboratory and service experience with thin metallic coatings used to protect gas turbine compressor components against corrosion are summarized. In laboratory tests one coating exhibited brittle erosion behavior and another exhibited ductile erosion. The coating of the compressor of a helicopter jet engine eroded away locally in a short time. However, the coating at the blade roots remained undamaged owing to the centrifuging of the erodent. Author (ESA)

# 08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

**N84-21551*#** Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
**AN OPTIMAL CONTROL APPROACH TO PILOT/VEHICLE ANALYSIS AND NEAL-SMITH CRITERIA**
Barton J. Bacon and David K. Schmidt Edwards, Calif. NASA. Ames Research Center Apr. 1984 160 p refs
(Grant NAG4-1)
(NASA-CR-170411; NAS 1.26:170411) Avail: NTIS HC A08/MF A01 CSCL 01C

The approach of Neal and Smith was merged with the advances in pilot modeling by means of optimal control techniques. While confirming the findings of Neal and Smith, a methodology that explicitly includes the pilot's objective in attitude tracking was developed. More importantly, the method yields the required system bandwidth along with a better pilot model directly applicable to closed-loop analysis of systems in any order. Author

**N84-21552*#** Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
**AN OPTIMAL CONTROL APPROACH FOR PILOT/VEHICLE ANALYSIS AND THE NEAL-SMITH CRITERIA**
Barton J. Bacon and David K. Schmidt Apr. 1983 33 p refs
(Contract NAG4-1)
(NASA-CR-170416; NAS 1.26:170416) Avail: NTIS HC A03/MF A01 CSCL 01C

In 1970, Neal and Smith presented a pilot-in-the-loop analysis technique for evaluating the attitude dynamics of highly augmented aircraft. Unfortunately, the methodology requires a priori selection of system bandwidth, and suffers the inherent problem of selecting the appropriate pilot model parameters. The goal is to merge the approach of Neal and Smith with the advances in pilot modeling by means of optimal control techniques. While confirming the findings of Neal and Smith, a methodology that explicitly includes the pilot's objective in attitude tracking is developed. More importantly, the method yields the required system bandwidth along with a better pilot model directly applicable to closed-loop analysis of systems in any order. Author

**N84-21553*#** Grumman Aerospace Corp., Bethpage, N.Y.
**BODY-FREEDOM FLUTTER OF A 1/2-SCALE FORWARD-SWEPT-WING MODEL, AN EXPERIMENTAL AND ANALYTICAL STUDY Final Report**
Richard Chipman, Frank Rauch, Melvyn Rimer, and Benigno Muniz Apr. 1984 257 p
(Contract NAS1-17102)
(NASA-CR-172324; NAS 1.26:172324; LD-10-901-164) Avail: NTIS HC A12/MF A01 CSCL 01C

The aeroelastic phenomenon known as body-freedom flutter (BFF), a dynamic instability involving aircraft-pitch and wing-bending motions which, though rarely experienced on conventional vehicles, is characteristic of forward swept wing (FSW) aircraft was investigated. Testing was conducted in the Langley transonic dynamics tunnel on a flying, cable-mounted, 1/2-scale model of a FSW configuration with and without relaxed static stability (RSS). The BFF instability boundaries were found to occur at significantly lower airspeeds than those associated with aeroelastic wing divergence on the same model. For those cases with RSS, a canard-based stability augmentation system (SAS) was incorporated in the model. This SAS was designed using aerodynamic data measured during a preliminary tunnel test in which the model was attached to a force balance. Data from the subsequent flutter test indicated that BFF speed was not dependent on open-loop static margin but, rather, on the equivalent closed-loop dynamics provided by the SAS. Servo-aeroelastic stability analyses of the flying model were performed using a computer code known as SEAL and predicted the onset of BFF reasonably well. Author

**N84-21554#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**MULTIPLE INPUT - MULTIPLE OUTPUT FLIGHT CONTROL DESIGN WITH HIGHLY UNCERTAIN PARAMETERS; APPLICATION TO THE C-135 AIRCRAFT M.S. Thesis**
Robert W. Betzold Dec. 1983 128 p
(AD-A138011; AFIT/GE/EE/83D-11) Avail: NTIS HC A07/MF A01 CSCL 01/2

This thesis demonstrates the design of a lateral flight controller for the C-135 aircraft using the frequency response approach of Professor Izaac Horowitz, University of Colorado, Boulder, Colorado. A single controller is designed for the entire flight envelope of the aircraft, from high speed, high altitude cruise to a low altitude approach condition. A three degree-of-freedom lateral model is reduced to a two degree-of-freedom model. The equations of motion assume a linearized aircraft model operating around equilibrium flight conditions allowing only small perturbations from equilibrium. Robustness of the design is guaranteed, since the variation in flight parameters is considered throughout the entire design process. Robustness is demonstrated by simulating the compensated aircraft at the extremes of the flight envelope considered. This thesis concludes that the approach of Professor Horowitz is useful for the design of flight controllers for the C-135 aircraft. Some software development to aid in the design process is recommended. Author (GRA)

**N84-21555#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**DEVELOPMENT AND FLIGHT TEST EVALUATION OF AN ANALYTICAL MODEL OF THE AIR-TO-AIR TRACKING TASK M.S. Thesis**
W. L. Eischens Sep. 1983 122 p
(AD-A138058; AFIT/GAE/AA/83S-2) Avail: NTIS HC A06/MF A01 CSCL 01/2

A nonlinear simulation and a linear model are developed for an air-to-air tracking task using the A-7D DIGITAC aircraft. The nonlinear simulation includes the aircraft, flight control system, and target dynamics, and the relative kinematics between aircraft and target. The linear model represents the linearized lateral-directional aircraft dynamics, the heading angle, and the linearized lateral relative kinematics. The models were used to describe the effect of depressing the aircraft roll axis on the air-to-air tracking task using a fixed gunsight. Open loop flight tests (spiral, Dutch roll, and roll mode tests, and lateral frequency sweeps) were performed to determine the effect of depressing the roll axis on the lateral-directional dynamics. The most noticeable open loop effect was the decrease in roll mode time constant. Comparison of the flight test and nonlinear model data showed good correlation for both the mechanical flight control system and the standard control augmentation system. The linear air-to-air tracking model did not agree with flight test data due to lack of a control system in the model. GRA

**N84-21556#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**MULTIVARIABLE DIGITAL FLIGHT CONTROL DESIGN FOR THE FPCC (FLIGHT PROPULSION CONTROL COUPLING) AIRCRAFT M.S. Thesis**
J. A. Simmers Dec. 1983 112 p
(AD-A138093; AFIT/GE/EE/83D-61) Avail: NTIS HC A06/MF A01 CSCL 01/3

Multivariable design techniques developed by Professor Brian Porter of the University of Salford, England, are used to develop digital control laws for the Flight Propulsion Control Coupling (FPCC) Aircraft. Control laws are developed for each of three flight conditions. A design tool, the computer program MULTI, is modified to calculate and display the figures of merit for each simulation. The controllers developed utilize output feedback with proportional plus integral (PI) control. Due to the nature of the system model, certain derivatives of the states are measured and added to the feedback. A robust controller is tested by performing specific maneuvers for multiple flight conditions, and these results are compared to those obtained with the controllers designed for each flight condition. The individual controllers and the robust controller are tested with the addition of a delay that represents the processing delay within the proportional plus integral implementation. The results with delay are compared to those without delay. All of the designs accomplished included first order models for the control surface actuators and assumed perfect knowledge of all aircraft states. The designs used reduced order state models with decoupled lateral and longitudinal models.
Author (GRA)

**N84-21557#** Naval Postgraduate School, Monterey, Calif.
**SURVIVABILITY DESIGN GUIDELINES FOR FLY-BY-WIRE FLIGHT CONTROL SYSTEMS DEVELOPMENT M.S. Thesis**
D. T. Hogan Dec. 1983 67 p
(AD-A138211) Avail: NTIS HC A04/MF A01 CSCL 01/4

Survivability of military combat aircraft has received increased emphasis in recent years. The primary objective of the U.S. Military Survivability Policy is to ensure that effective survivability enhancement features are incorporated in current and all future U.S. combat aircraft. Technology advances in Fly-By-Wire Flight Control Systems have significantly enhanced the performance capabilities of modern fighter/attack aircraft. In consonance with the military services survivability policy, a series of survivability design guidelines for Fly-By-Wire Flight Control Systems which have been developed are presented. A recommendation for future survivability enhancement through the use of digital flight control technology, in a manner similar to artificial intelligence, is presented. GRA

**N84-21558#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**EVALUATION OF A DIGITAL FLIGHT CONTROLLER FOR A FLEXIBLE-FIGHTER AIRCRAFT M.S. Thesis**
M. L. Hoffman Dec. 1982 159 p
(AD-A138269; AD-E950472; AFIT/GE/EE/83D-30) Avail: NTIS HC A08/MF A01 CSCL 01/4

This thesis evaluates the effect of a digital flight controller on a flexible-fighter aircraft (FFA) at 0.8 Mach at 30,000. The two maneuvers incorporated in this flight controller are the g-command pull-up and the pitch-pointing maneuvers. Using a control law based on the control system theory developed by Brian Porter, a digital flight controller is first designed for a rigid body aircraft, and is then used on the FFA. This thesis evaluates the effect of the controller for the rigid body design when used on the flexible-fighter. The results showed excellent performance by the FFA.

The flexible-fighter model is based on the rigid body dynamics of the AFTI/F-16 combined with the first bending mode of a flexible aircraft. The bending mode of the FFA was selected to correspond to expected characteristics in a typical fighter aircraft. Incorporating a time delay in the controller to represent the expected microprocessor computational time delay did not significantly affect the simulation time response of either the rigid body or the FFA. The Neal-Smith criterion is used to determine the acceptance of the design by a pilot. GRA

**N84-21559#** Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
**ON THE STABILITY OF FLIGHT VEHICLES IN THE LOW REYNOLDS NUMBER NON-LINEAR REGIME Interim Report**
E. E. Covert, O. W. K. Lee, and C. M. Vaczy Jan. 1984 60 p
(Contract N00014-82-K-0310)
(AD-A138379) Avail: NTIS HC AC4/MF A01 CSCL 20/4

This report addresses some issues associated with dynamic stability of vehicles flying at speeds such that the flight Reynolds number is of the order of a few hundreds of thousands. In particular the wing loading and speed are such that the flight occurs at relatively high angles of attack. Under these circumstances the aerodynamic characteristics of the vehicle are likely to be non-linear in nature. Here the nature of the flight itself could be significantly different from that expected under those conditions where the aerodynamic characteristics are linear. As a result of this study the authors conclude that the usefulness of the linearized stability analysis is limited when applied to flight at high lift coefficients at low Reynolds numbers. This study highlights the need for additional reliable data in this Reynolds number range in several forms: (1) Static aerodynamic characteristics; (2) Dynamic stability derivatives measured with small amplitude at a variety of set points; and (3) Some trajectory simulation data using a dynamic, perhaps a magnetic model suspension system, to probe for unexpected, non-linear aerodynamic coupling. GRA

**N84-21560#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**ROBUST FLIGHT CONTROLLERS M.S. Thesis**
J. M. Howey Dec. 1983 272 p
(AD-A138425; AFIT/GAE/EE/83D-2) Avail: NTIS HC A12/MF A01 CSCL 12/1

This study examines the concept of robustifying a controlled system against differences which may exist between the real world system and the low-order design model upon which the controller design is based. The types of controllers considered are based upon the Linear system model, Quadratic cost, and Gaussian noise process methodology of optimal control theory. It is assumed that full-state feedback is not available and a Kalman filter is employed to provide state estimates to the controller. Both continuous-time and sampled-data controllers are considered. Two robustification techniques are considered. The first is the method of injecting zero-mean white Gaussian noise into the design model at the point of entry of the control inputs during the process of tuning the Kalman filter. The second method is an extension of the first, where the white noise is replaced by a time-correlated noise. This allows the primary strength of the noise to be concentrated only in the frequency range where robustification is desired. Comparing the results of applying the two methods allows a designer to make a trade-off between the amount of desired robustification and the performance degradation at the design conditions which occurs when the techniques are applied. Both methods are found to improve substantially the robustness properties of the controllers considered. GRA

# 09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

**N84-21561#** Joint Publications Research Service, Arlington, Va.
**CHINA REPORT: SCIENCE AND TECHNOLOGY**
5 Apr. 1984 34 p Transl. into ENGLISH from various Chinese articles
(JPRS-CST-84-009) Avail: NTIS HC A03

This serial report contains news items, abstracts and articles of scientific reports on the People's Republic of China including national developments, applied sciences, life sciences and journal abstracts on medicine, lasers, physics, geology, electronics, and astronautics. For individual titles, see N84-21562 through N84-21562.

**N84-21562#** Joint Publications Research Service, Arlington, Va.
**FIRST CHINESE-BUILT FIGHTER SIMULATOR DESCRIBED**
Ri Xin *In its* China Rept.: Sci. and Technol. (JPRS-CST-84-009) 5 Apr. 1984 p 5-7 Transl. into ENGLISH from Hangkong Zhishi (Beijing), no. 1, 6 Jan. 1984 p 4-5 (For primary document see N84-21561 12-09)
Avail: NTIS HC A03

The first Chinese-built fighter simulator was certified by the government for operation by the Air Force. The flight simulator is composed of three parts: (1) the computer system, which is located in the computer room, the main machine room, and the visual scenery room; (2) the mobile simulator cabin; and (3) the visual scenery production system. The main machine room is the front stage of the simulator theater, where flight instructors conduct their teaching and command duties and student pilots receive their flight training. On the left side of the main machine room is a flight command console. Throught the command console, flight instructors perform the functions of teaching, commanding, and testing the student pilots. B.G.

**N84-21563#** Alabama Univ., Huntsville. Dept. of Mathematics.
**CENTRALIZED MONITORING AND CONTROL OF ENVIRONMENTAL CHAMBERS BY DIGITAL COMPUTER**
S. J. Dow Aug. 1983 40 p
(Contract DAAG29-81-D-0100)
(AD-A138278; AD-E950489; DRSMI/RT-CR-83-2) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report documents the system which is being developed to monitor and control environmental chambers operated by the US Army Missile Laboratory at Redstone Arsenal, Alabama. It also touches on the control theory needed and describes in some detail the software at its present stage of development.
Author (GRA)

**N84-21564#** Georgia Inst. of Tech., Atlanta.
**OPERATIONAL EVALUATION OF A NEW 435-mHz RADIATION FACILITY Final Report, Sep. 1981 - Aug. 1982**
J. C. Toler and V. P. Popovic Dec. 1983 45 p
(Contract F33615-81-K-0620; AF Proj. 7757)
(AD-A138474; USAFSAM-TR-83-21) Avail: NTIS HC A03/MF A01 CSCL 06/18

A unique 435-mHz radiofrequency radiation exposure facility--constructed at the Georgia Institute of Technology under U.S. Air Force sponsorship--has been operationally evaluated for conducting long-term animal studies. The exposure device is a 4-tier, 12-ft-diam., circular, parallel-plate waveguide arrangement. Slotted-cylinder antennas feed the waveguide and generate a horizontally polarized field. An identical unpowered system is used for sham-exposure control. The facility consists of: the waveguides, located in separate rooms; and a suite of support rooms, for animal preparation, data collection, and cage washing. The facility can

house 100 exposed rats and 100 sham-exposed rats. The triple purpose of this study has been to evaluate the system, integrate several subsystems, and train technologists in operating the system. All exposed and sham-exposed animals were anesthetized (Nembutal) and implanted with plastic cannulas in the aortic arch and exteriorized at the back of the neck. Blood was drawn, via the cannula, at weekly intervals; and ACTH, corticosterone, and prolactin were assayed. GRA

**N84-21565#** Naval Civil Engineering Lab., Port Hueneme, Calif.
**DESIGN GUIDELINES FOR HEATING AIRCRAFT HANGARS WITH RADIANT HEATERS Technical Note, Oct. 1982 - Sep. 1983**
E. L. Correa Dec. 1983 34 p
(Z0829)
(AD-A138496; NCEL-TN-1684) Avail: NTIS HC A03/MF A01 CSCL 13/1

An investigation was conducted on the use of radiant heaters to reduce the cost of heating aircraft hangars. Those best suited for space heating aircraft hangars were found to be the gas-fired, high-intensity, porous, refractory infrared heaters. Radiant heaters provide increased thermal comfort for personnel while substantially reducing heating costs. Considerable fuel is saved by: (1) allowing a lower interior air temperature to be maintained while providing personnel comfort, (2) reducing heat stratification, (3) reducing fuel consumption with high efficiency burners, (4) reducing building heat loss, and (5) heating only occupied areas rather than the whole building. This report includes the principles of radiant heating in hangars, guidelines for optimum system design, and discussion of the physiological aspects of radiant heating. Cost analysis procedures are given for determining the cost-effectiveness of the radiant systems for comparison with other types of heating systems. GRA

# 12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

**N84-21566#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: SPACE**
16 Mar. 1983 97 p refs Transl. into ENGLISH from various Russian articles
(JPRS-USP-84-002) Avail: NTIS HC A05

This serial report contains news items, abstracts and articles of scientific reports on aspects of space including manned mission highlights, space sciences, interplanetary sciences, life sciences, space engineering, space applications, and space policy and administration. For individual titles, see N84-21567 through N84-21585.

**N84-21567#** Joint Publications Research Service, Arlington, Va.
**LYAKHOV AND ALEKSANDROV WORK WITH PION EXPERIMENT ON SALYUT-7**
A. Ivakhnov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 1-3 Transl. into ENGLISH from Izv. (Moscow), 1 Oct. 1983 p 2 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

Effects of long duration space flight on the cosmonauts were discussed. Also crystal growth of alloys, glasses, and semiconducting materials were described. B.G.

**N84-21568#** Joint Publications Research Service, Arlington, Va.
**MATERIALS STUDY EXPERIMENTS WITH ELEKTROTOPOGRAF ON SALYUT-7**
A. Pokrovskiy *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 4-6 Transl. into ENGLISH from Pravda (Moscow), 14 Aug. 1983 p 6 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

Damage assessment of the Salyut 7 Space Station was discussed. The long term effects on the thermal control coatings were described. Electrotopography of several crystal samples was performed onboard the station, rather than on return to Earth. B.G.

**N84-21569#** Joint Publications Research Service, Arlington, Va.
**COSMONAUTS EVALUATE COLOR RESULTS FROM ELEKTROTOPOGRAF EXPERIMENT**
A. Ivakhnov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 7-9 Transl. into ENGLISH from Izv. (Moscow), 18 Oct. 1983 p 2 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

An electric field also affects photographic film, just like light waves. If a thin layer of some material is placed next to the film and they are mounted together between the plates of a condenser, all the defects in the material are recorded on the film, even those that are seen only through a microscope. On this basis a promising method was developed for nondestructive inspection and it is already be used in many sectors. The space equipment designers asked for help in using this method to observe the condition of materials that in orbit are bombarded with micrometeorites and subjected to the effects of the atmosphere surrounding the station and all possible kinds of radiation. Author

**N84-21570#** Joint Publications Research Service, Arlington, Va.
**RESULTS FROM FIRST SERIES OF ELEKTROTOPOGRAF EXPERIMENTS**
A. Kravtsov and M. Shpak *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 10-12 Transl. into ENGLISH from Pravda (Moscow), 16 Nov. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

Good quality electrotopograms of 12 samples were obtained after five successive exposures in open space. The effects of exposure to quantums of ultraviolet radiation, streams of protons and electrons, the effect of meteorites and temperature drops, and interaction with chemical substances in the atmosphere near the station were studied. B.G.

**N84-21571#** Joint Publications Research Service, Arlington, Va.
**DISCUSSION OF COSMONAUT EVA FOR SOLAR BATTERY INSTALLATION**
A. Ivakhnov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 13-15 Transl. into ENGLISH from Izv. (Moscow), 4 Nov. 1983 p 2 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

Installation of solar batteries to the Salyut space station were accomplished. Performance of the cosmonauts was monitored during the extravehicular activity. B.G.

**N84-21572#** Joint Publications Research Service, Arlington, Va.
**DETAILS OF COSMONAUTS' INSTALLATION OF SOLAR BATTERIES** c44
V. Vladimirov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 16-18 Transl. into ENGLISH from Pravda (Moscow), 4 Nov. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

An account is given of the installation of solar batteries in the Salyut space station. The power of the station was increased by one half. Details of the two-man operation are given. R.J.F.

**N84-21573#** Joint Publications Research Service, Arlington, Va.
**LANDING OF SOYUZ T-9 COSMONAUTS**
A. Ivakhnov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 19-22 Transl. into ENGLISH from Izv. (Moscow), 25 Nov. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

An account is given of the landing of the Soyuz T-9 cosmonauts. A brief discussion concerning the installation of solar battery panels on the Cosmos 1443 support vehicle is given, as well as an account of the recovery of the Soyuz T-9 after its water landing. R.J.F.

**N84-21574#** Joint Publications Research Service, Arlington, Va.
**FLIGHT DIRECTOR RYUMIN ON ACHIEVEMENTS OF SOYUZ**

**T-9 FLIGHT**
A. Pokrovskiy *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 23-24 Transl. into ENGLISH from Pravda (Moscow), 20 Nov. 1983 p 6 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

An account is given of the accomplishments of the Soyuz T-9 flight. The installation of solar batteries on the Cosmos 1443 support vehicle is discussed. The division of complex substances using electrophoresis in space is discussed in reference to an experiment to obtain a pure protein preparation from the membranes of influenza virus for use in making molecular anti-influenza vaccines. R.J.F.

**N84-21575#** Joint Publications Research Service, Arlington, Va.
**TECHNIQUES AND INSTRUMENTS FOR COSMONAUT REMOTE SENSING c43**
L. Kiselevskiy and V. Kovalenok *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 28-30 Transl. into ENGLISH from Pravda (Moscow), 5 Aug. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

A brief discussion of the application of remote sensing techniques to the investigation of natural resources is given. An account is given of a space walk to check the Salyut-6 docking assembly and to test the cosmonauts space suits. R.J.F.

**N84-21576#** Joint Publications Research Service, Arlington, Va.
**ASTRON SATELLITE c15**
V. A. Kotelnikov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 31-33 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow), no. 4, Jul. - Aug. 1983 p 2-3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

The instrumentation of the Astron satellite is discussed. The operation of the ultraviolet telescope and the X-ray spectrometer is described. R.J.F.

**N84-21577#** Joint Publications Research Service, Arlington, Va.
**RESEARCH CONTINUES WITH INTERCOSMOS-BOLGARIYA-1300 SATELLITE c15**
V. Adasko, V. Balebanov, and K. Serafimov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 34-36 Transl. into ENGLISH from Pravda (Moscow), 2 Sep. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

The use of the Intercosmos-Bolgariya-1300 satellite to investigate to study Earth's ionosphere and magnetosphere is discussed. New scientific results in the electrical fields and in the ions, which may be the reason that charged particle accelerate. Preliminary data from a study of anisotropic plasma, that is irregularities in the physical properties of ions and electrons moving in various directions, also indicate the existence of acceleration effects in the electrical field. Accurate measurements of the electrical and magnetic fields became possible thanks to the good orientation of the satellite along three axes and the steps taken to insure electromagnetic compatibility between onboard instruments and the space apparatus itself. The spectrums of the aurora borealis were obtained. R.J.F.

**N84-21578#** Joint Publications Research Service, Arlington, Va.
**ACADEMICIAN BARSUKOV INTERVIEWED ON VENERA RESULTS**
B. Konovalov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 43-45 Transl. into ENGLISH from Izv. (Moscow), 11 Oct. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

The planetary atmosphere of Venus is described. The study of the planetary surface has provided new knowledge on the formation and development of the Earth. B.W.

**N84-21579#** Joint Publications Research Service, Arlington, Va.
**DESIGN MODIFICATIONS ON VENERA-15, -16 c15**
B. Konovalov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 46-48 Transl. into ENGLISH from Izv. (Moscow), 21 Oct. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

The Venusian surfae was observed by Venera-15, -16 satellites. For the first time in history the radar aboard the Venera-15 was making it possible to obtain an image of the north polar region on this distant planet--a region that terrestrial science knew nothing about with certainty. Much effort went into development of the heart of the research complex--the side-looking radar, which was designated Polyus V. The latest achievements of radar, radioelectronics, computer technology and modern electronics technology were used in its development. The apparatus was based on integrated microcircuits and is very compact. B.W.

**N84-21580#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT OF VENERA-15, -16 RADARS c32**
V. Gubarev *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 49-51 Transl. into ENGLISH from Pravda (Moscow), 21 Oct. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

Venera-15 and 16 show a family resemblance to previous stations in the way they are constructed. But because they have specific missions, the work on them demanded essentially new solutions from the designers, engineers and workers at the spacecraft factory. Venera-15 and 16 underwent a complete cycle of ground trials. Where in the previous ships the landing system was located, there now is a set of scientific equipment, especially the sidescanning radar units. Two antennas are located in the forward part. The size of the solar batteries was increased, a system of precise astro-orientation was installed, a new telemetry line was required to provide a ten-fold increase in the volume of data relayed to Earth, more fuel was required for the ships' work in orbit, etc. They were essentially new designs and therefore required a full cycle of preparation for launch and work in space as though they were totally new spacecraft. B.W.

**N84-21581#** Joint Publications Research Service, Arlington, Va.
**FIRST IMAGERY FROM VENERA-15, -16 SHOWN c91**
A. Pokrovskiy *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 52-55 Transl. into ENGLISH from Pravda (Moscow), 17 Nov. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

Radar observations of the Venusian surface are described. The Soviet vehicles Venera-15 and -16 are photographing the Northern Hemisphere of the morning star, which never before was accessible to the human eye. The highly complex imaging systems are performing flawlessly. B.W.

**N84-21582#** Joint Publications Research Service, Arlington, Va.
**FOURIER SPECTROMETRY RESEARCH ON VENERA-15, -16 c91**
V. Moroz and V. Linkin *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 56-59 Transl. into ENGLISH from Pravda (Moscow), 17 Dec. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

At present two artificial satellites are operating in orbits around Venus. Both of these spacecraft were created primarily to map the surface of our heavenly neighbor with the help of radar. But the Venera 15 and 16 program of scientific investigations includes another important task: remote probing of the atmosphere. This is accomplished by two methods--infrared spectrometry and radar illumination. Author

**N84-21583#** Joint Publications Research Service, Arlington, Va.
**FORECASTING SATELLITE MOTION c15**
Yuiry Alekseyevich Lukyanov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 66-68 Transl. into ENGLISH from Aviats. i Kosmonavtika (Moscow), no. 5, May 1983 p 44-45 (For primary document see N84-21566 12-12)

Avail: NTIS HC A05

Methods which are used for computer satellite orbit and orbital life-time are discussed. Error sources are identified for greater forecasting precision. B.W.

**N84-21584#** Joint Publications Research Service, Arlington, Va.
**BENEFITS FROM SATELLITE PROGRAMS CITED c18**
B. Konovalov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 73-77 Transl. into ENGLISH from Izv. (Moscow), 1 Sep. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

More than 1,500 satellites have now been launched in the U.S.S.R. Satellite applications and the cost of those applications are explained. B.W.

**N84-21585#** Joint Publications Research Service, Arlington, Va.
**LIST OF RECENT SOVIET SPACE LAUNCHES c15**
*In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 88-89 Transl. into ENGLISH from Tass (Moscow) (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

A list of recent Soviet space launches is presented. Various orbital parameters are described. B.W.

**N84-21586*#** Arizona State Univ., Tempe. Dept. of Geology.
**FEASIBILITY STUDY TO CONDUCT WINDBLOWN SEDIMENT EXPERIMENTS ABOARD A SPACE STATION Final Report**
Ronald Greeley and James D. Iversen (Iowa State Univ., Ames) 30 Aug. 1983 36 p refs Original contains color illustrations
(Contract NASw-3741)
(NASA-CR-175434; NAS 1.26:175434) Avail: NTIS HC A03/MF A01 CSCL 22A

A feasibility study was undertaken to determine if a suitable apparatus could be designed to analyze aeolian processes for operation in space and to assess the feasibility of conducting meaningful experiments to address key aspects of aeolian processes. To meet this objective a prototype apparatus was fabricated and some limited experiments were run to determine its suitability for this application. At least three general types of experiments were devised that could be carried out aboard a space station: threshold studies, swirl (dust devil) experiments, and analyses of windblown particle trajectories. How experiments in a zero-g environment could advance knowledge of aeolian processes was studied. M.A.C.

**N84-21587*#** Lowell Observatory, Flagstaff, Ariz. Planetary Research Center.
**POST-MISSION VIKING DATA ANAYSIS Final Report**
William A. Baum, Leonard J. Martin, Kari Lumme, and Lawrence H. Wasserman 26 Apr. 1984 6 p
(Grant NsG-7530)
(NASA-CR-173451; NAS 1.26:173451) Avail: NTIS HC A02/MF A01 CSCL 22A

Three Mars data analysis projects from the Viking Mars program were identified initially, and three more came into being as the work proceeded. All together, these six pertained to: (1) the veritical distribution of scattering particles in the Martian atmosphere at various locations in various seasons, (2) the physical parameters that define photometric properties of the Martian surface and atmosphere, (3) patterns of dust-cloud and global dust-storm development, (4) a direct comparison of near-simultaneous Viking and ground-based observations, (5) the annual formation and dissipation of polar frost caps, and (6) evidence concerning possible present-day volcanism or venting. A list of publications pertaining to the appropriate projects is included. M.A.C.

**N84-21588#** Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Main Dept. Vorprojekte und Studien.
**SYSTEM FEASIBILITY STUDY ON RENDEZVOUS AND DOCKING IN TRANSFER ORBIT, VOLUME 1 Final Report**
H.-J. Heidmann, W. Wolfsberger, R. Burkert, A. Getzschmann, and J. Bock Paris ESA Dec. 1982 160 p refs 2 Vol.
(Contract ESA-4870/81/NL-AK(SC))
(PV6-13/82-Vol-1; ESA-CR(P)-1803-Vol-1) Avail: NTIS HC A08/MF A01

The technical feasibility of a rendezvous and docking concept, (RVD) on geostationary transfer orbit (GTO) between a communication satellite as target, and a dedicated propulsion module as chaser, both launched by Ariane 3, is investigated. For an assumed layout of the 2000 kg satellite, a 2600 kg medium energetic, bipropellant chaser design is conceived including all its subsystems. The corresponding mission profile, including the guided phase underground station command, homing, final approach and docking under on board guidance, as well as the subsequent ground guided insertion into GEO, is established. Each mission phase is analyzed as to its content and problematics and appropriate system or hardware solutions are defined. Thus the RVD concept builds upon an S-band far range guidance sensor, a camera system as short range guidance sensor, 4 x 400 N thrusters supplemented by 10 N reaction control system (RCS) thrusters and an active soft impact docking adapter. The RVD functions sharing between the two 3-axis stabilized spacecraft is so that primarily the chaser is burdened with the active systems, while the target is carrying only the supplementary equipment. M.A.C.

**N84-21589#** Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Main Dept. Vorprojekte und Studien (PRV).
**SYSTEM FEASIBILITY STUDY ON RENDEZVOUS AND DOCKING IN TRANSFER ORBIT, VOLUME 2 Final Report**
H.-J. Heidmann, W. Wolfsberger, R. Burkert, A. Getzschmann, and J. Bock Paris ESA Dec. 1983 187 p 2 Vol.
(Contract ESA-4870/81/NL-AK(SC))
(PRV6-13/82; ESA-CR(P)-1803-Vol-2) Avail: NTIS HC A07/MF A01

The space segments design concepts, that is, those of the target and the chaser are discussed. The chaser poses the prime subject, and accordingly, most of the material given in this volume pertains to it. The target satellite is the more passive RVD partner as well as the GEO injection payload of the chaser after docking. The chaser spacecraft is a propulsion module capable of performing the active part of a rendezvous and docking (RVD) process as well as the injection of a payload in apogee. The baseline chaser configuration is an integral, two tank, middle energetic, propulsion stage. The chaser fully complies with the Ariane's payload interface requirements. M.A.C.

## 13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

**N84-21590#** European Space Agency, Paris (France).
**INTRODUCTION TO GEOSTATIONARY ORBITS**
E. Mattias Soop (ESOC, Darmstadt, West Germany) and W. R. Burke, ed. Nov. 1983 148 p refs
(ESA-SP-1053; ISSN-0379-6566) Avail: NTIS HC A07/MF A01

The laws governing spacecraft motion in geostationary orbit, and the orders of magnitude of perturbing effects on the orbit are discussed. Orbital maneuvers, perturbed orbits, in orbit control, eclipse effects, stationkeeping, and orbit determination are introduced. Author (ESA)

**N84-21591#** Technische Hogeschool, Delft (Netherlands). Section Orbital Mechanics.
**PRECISE ORBIT DETERMINATION FOR ERS-1**
K. F. Wakker, B. A. C. Ambrosius, and L. Aardoom Paris ESA Aug. 1983 296 p refs
(Contract ESOC-5227/82/D-IM(SC))
(ESA-CR(P)-1842) Avail: NTIS HC A13/MF A01

Orbit determination accuracy for ERS-1 (ESA) was analyzed using geometric and dynamic models with accuracies extrapolated to launch date. The error model was applied for long and short arc orbit determination simulations using laser range, TRANET

Doppler and PRARE range measurements. The effect of lowering the orbit altitude, and orbit accuracy improvement achievable by tailoring a gravity model to ERS-1 were investigated. The application of the NAVSTAR global positioning system for tracking ERS-1 is discussed and the feasibility of using the altimeter as a tracking instrument is demonstrated by processing SEASAT laser and altimeter measurements. Author (ESA)

# 14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

**N84-21592*#** Rockwell International Corp., Downey, Calif. Space Operations Center.
**SHUTTLE INTERACTION STUDY Quarterly Review**
3 Sep. 1980 86 p
(Contract NAS9-16153)
(NASA-CR-173400; NAS 1.26:173400; PD80-55; QR-1) Avail: NTIS HC A05/MF A01 CSCL 14B

The role of the Space Operations Center (SOC) as it effects the missions of the space shuttle was analyzed. Graphic representation of space shuttle docking procedures with attention to the docking module was presented. Other topics included extravehicular activity options, space station evaluation, space logistics of the SOC, equipment interfacing, and SOC buildup scenarios. M.A.C.

**N84-21593*#** Rockwell International Corp., Downey, Calif. Space Operations Center.
**SHUTTER INTERACTION STUDY EXTENSION Monthly Progress Report, 6 Oct. - 6 Nov. 1981**
Oct. 1981 14 p
(Contract NAS9-16153)
(NASA-CR-173401; NAS 1.26:173401; MPR-3) Avail: NTIS HC A02/MF A01 CSCL 14B

Plans for space shuttle missions as they effect the Space Operation Center (SOC) were examined. Shuttle fleet utilization, traffic analysis, SOC assembly operations, SOC propellant storage, and flight support facilities were studied with cost estimates, and completion schedules included. M.A.C.

**N84-21594*#** Rockwell International Corp., Downey, Calif. Space Operations Center.
**SHUTTLE INTERACTION STUDY EXTENSION Final Review**
Feb. 1982 257 p
(Contract NAS9-16153)
(NASA-CR-173398; NAS 1.26:173398; PD82-1A) Avail: NTIS HC A12/MF A01 CSCL 14B

The following areas of Space Shuttle technology were discussed: variable altitude strategy, spacecraft servicing, propellant storage, orbiter plume impingement, space based design, mating (docking and berthing), shuttle fleet utilization, and mission/traffic model. B.G.

**N84-21595*#** Rockwell International Corp., Downey, Calif. Space Operations Center.
**SHUTTER INTERACTION STUDY Monthly Progress Report, 19 Sep. - 24 Oct. 1980**
Oct. 1980 68 p
(Contract NAS9-16153)
(NASA-CR-173402; NAS 1.26:173402; MPR-3) Avail: NTIS HC A04/MF A01 CSCL 14B

The deployment, transport, and exchange procedures for the SOC logistics module and for logistics modules/cradles envisioned to support both the flight support facilities operation and the space construction operation were developed. The use of a holding and positioning aid device was determined to be the most desirable arrangement for the parking/holding of the modules during this exchange operation. The capability/feasibility of transporting eight crew members in the orbiter to and from the SOC was analyzed. Two arrangements were defined for this operation: (1) with the airlock in the orbiter cabin, and (2) with no airlock in the cabin. Author

**N84-21596*#** Rockwell International Corp., Downey, Calif. Space Operations/Integration and Satellite Systems Div.
**SHUTTLE INTERACTION STUDY EXTENSION Midterm Review**
15 Oct. 1981 160 p
(Contract NAS9-16153)
(NASA-CR-173403; NAS 1.26:173403; PD81-20A) Avail: NTIS HC A08/MF A01 CSCL 14B

The implications of using the Shuttle with the SOC were analyzed, including constraints that the Shuttle places upon the SOC design. All the considerations involved in the use of the shuttle as a part of the SOC concept were identified. Author

# 15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

**N84-21597*#** Lockheed Missile and Space Co., Burbank, Calif.
**SATELLITE SERVICES HANDBOOK. INTERFACE GUIDELINES Final Report**
23 Dec. 1983 90 p refs
(Contract NAS9-15800)
(NASA-CR-171774; NAS 1.26:171774; LMSC-D931647) Avail: NTIS HC A05/MF A01 CSCL 22B

Satellite interfaces for on orbit servicing, both manned and unmanned are identified, and is intended to be used by designers of space vehicles, both foreign and domestic. A primary concern is for design of interfaces with the astronaut in the loop, especially extravehicular activity, but also intravehicular activity and operations that are remote but have man-in-the-loop. The main emphasis is on servicing in low earth orbits from the Space Shuttle and also from the Space Station or other platforms. Author

**N84-21598*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**HOT MELT ADHESIVE PAD SURFACE ATTACHMENT ASSEMBLY CONCEPT FOR ON-ORBIT OPERATIONS**
Donald J. Progar and Bland A. Stein Mar. 1984 78 p
(NASA-TM-85771; NAS 1.15:85771) Avail: NTIS HC A05/MF A01 CSCL 22A

The use of a hot melt adhesive concept to develop a Surface Attachment Assembly (SAA) for on-orbit attachment and detachment operations for the Manned Maneuvering Unit (MMU) was investigated. The concept involved impregnation of the hot melt adhesive into a fiberglass covered pad which contained electrical heating and thermoelectric cooling devices. The polyamide hot melt adhesive selected can be repeatedly heated to its melting point in a vacuum and provide good adhesion to various surfaces, i.e., reusable surface insulation tiles, metals, and composites, when cooled. After a series of adhesive screening tests, Jet-Melt 3746 was selected from a group of commercially available thermoplastic adhesive candidates which met or exceeded many of the criteria established for the SAA system. The SAA system was designed and fabricted with the goal of proving the concept with a working model rather than attempting to optimize all facets of the system. This system evolved by investigating alternate attachment concepts, designing and fabricating electronic systems to heat and cool the adhesive, and then fabricating electronic systems to heat and cool the adhesive, and then fabricating and testing two prototype full-size units. M.A.C.

**N84-21599#** National Aerospace Lab., Tokyo (Japan).
**AN EXPERIMENTAL STUDY ON THE INDUCED ROLLING MOMENT DUE TO WING-TAIL INTERFERENCE AND ROLL-CONTROLLABLE TWO-STAGE ROCKET**
Masao Shirouzu, Kunio Soga, Takashi Yamazaki, Yoji Shibato, and Toshio Akimoto 1983 50 p refs In JAPANESE; ENGLISH summary
(NAL-TR-793; ISSN-0389-4010) Avail: NTIS HC A01/MF A01

A wind tunnel investigation of a roll-controllable two-stage rocket model was made at free-stream Mach numbers from 0.5 to 2.5. The model has ailerons on front-fins to generate rolling moment and free-rolling tail-fins to eliminate the effect of the induced rolling moment on tail-fins. The results confirmed the feasibility of this type of roll-controllable rocket. The characteristics of the induced rolling moment were investigated by tests of a model with fixed tail-fins. The characteristics were compared with theoretical results based on the strip-theory. Values of roll-damping coefficient of the tail-fins were obtained by analyzing their rolling rate. The effect of the free-rolling tail-fins on other aerodynamic characteristics, such as normal force coefficient, center of pressure and axial force coefficient were also evaluated. A computer simulation of the rolling motion of the TT-500A rocket, which has a similar configuration to the present model, was made based on the results of the present study, whose results agreed well with the flight-data. Author

**N84-21600#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**EFFECT OF DATA LATENCY UPON MISSILE ACCURACY M.S. Thesis**
L. J. Monroe Dec. 1983 291 p
(AD-A138048; AFIT/GE/EE/83D-49) Avail: NTIS HC A13/MF A01 CSCL 17/7

This study examined the effect of data latency upon air-to-air guided missile accuracy. This research was done by modeling a digital guided missile, inserting the model into a computer simulation and generating miss distance statistics. The digital guided missile was modeled after the DIS microcomputer architecture. The DIS (Digital Integrating Subsystem) approach involves a number of loosely coupled microprocessors which communicate over a serial multiplex bus. It was developed at the Air Force Armament Lab., Eglin AFB, FL. The missile simulation, Tactics IV, involves three degrees of freedom and is written in FORTRAN IV. It was developed by Science Applications, Inc. in conjunction with AFWAL/FIMB, Wright Patterson AFB, OH. The results of this study indicate that typical data latency values generate only small increases in miss distance. The maximum delays tested were .01 seconds and the average increase in miss distance was 2.12 feet. Additionally, it was discovered that the transmission rate of the DIS microcomputers greatly affected miss distance. Microcomputers transmitting at 10 HZ generated large miss distances, even without data latency present. The identical missile engagements using transmission rates of 100 HZ resulted in much smaller miss distances. GRA

**N84-21601#** Analytics, Inc., Willow Grove, Pa.
**THE ROLE OF SIMULATION IN HIGH TECHNOLOGY MISSILE APPLICATIONS**
F. M. Belrose and A. M. Baird 27 Apr. 1983 18 p
(Contract DAAH01-81-C-B057)
(AD-A138277; AD-E950472; TN-106-010; DRSMI/RD-CR-83-23) Avail: NTIS HC A02/MF A01 CSCL 14/2

This document provides an overview of the ASC approach to missile system simulation, defines the role of simulation in relation to other methods of system performance evaluation, and presents the potential benefits to be derived from simulation support over the weapon system life cycle. The topics discussed include ASC philosophy and methodology, simulation capabilities, and the ASC management approach. This document also describes the ASC approach to environmental modeling and the verification and validation program which ensures both model and simulation realism and credibility. A summary highlights key points contained in this document. Author (GRA)

**N84-21602#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**THE EARTH SYNCHRONOUS SATELLITE CARRIER ROCKET**
Y. Zhou 26 Jan. 1984 16 p Transl. into ENGLISH from Hangkong Zhishi (China), no. 8, Aug. 1983 p 6-8
(AD-A138504; FTD-ID(RS)T-1787-83) Avail: NTIS HC A02/MF A01 CSCL 22/4

The use of synchronous satellites for telecommunication was discussed. Also discussed were ascent trajectories, energy consumption and booster rocket engines (Delta, Atlas, Titan Centaur, Proton, Orion and N). B.G.

**N84-21603#** National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
**A TORQUE MOTOR FOR A LOW FRICTION SINGLE AXIS TURNTABLE**
L. J. M. Joosten 16 Aug. 1982 8 p In DUTCH; ENGLISH summary Presented at Ned. Electron.- en Radiogenootschap (NERG), 12 Nov. 1981
(NLR-MP-82036-U) Avail: NTIS HC A02/MF A01

A single axis turntable motor for a virtually frictionless turntable used for testing satellite attitude control systems is described. The torque motor simulates pulse jets for attitude control, low torques acting on the satellite, and compensates disturbance torques acting on the table. The torques are applied by forcing a current in the ironless rotor fixed to the ground, while the permanent magnet stator transfers the torques to the turntable, to which the stator is attached. The rotor is mounted on a servocontrolled subtable so that the angular position of the stator and rotor is maintained, in order to keep the torque transfer independent of the turntable position. The torquer can accept pulses as short as 3 msec and has a gain accuracy better than 0.5% within its range of 50 times 10 to the power -3 nanometers. The torquer is used to compensate the position dependent disturbance torques on the turntable, so that the friction of the table is lowered towards 3 times 10 to the power -6 nanometers. Author (ESA)

**N84-21604#** European Space Agency, Paris (France).
**DERIVATION AND COMBINATION OF IMPEDANCE MATRICES FOR FLEXIBLE SATELLITES**
E. Crellin (ESTEC, Noorwidjk, Netherlands) and F. Janssens (ESTEC, Noorwidjk, Netherlands) Nov. 1983 107 p refs
(ESA-STR-209; ISSN-0379-4067) Avail: NTIS HC A06/MF A01

The concept of the impedance matrix of a dynamical system is presented as a tool for the study of the small vibrations about equilibrium of a satellite with flexible appendages (attitude dynamics). A method which avoids the derivation of the equations of motion of the global system and does not require discretization of the flexible appendage a priori is developed. The impedance of the global system enables the study of the attitude dynamics and it can be constructed, in a systematic way, from the subsystem impedances. Impedances for typical subsystems of spinning satellites are derived. The method of combination of the subsystem impedances is used to derive global system impedances for GEOS, ISPM, ISEE-B, ESRO-4 and IMP-J satellites. Author (ESA)

**N84-21605#** Engineering System International, Rungis (France).
**STUDY OF ANALYSIS METHODS CONCERNING LAUNCH VEHICLE AND SPACECRAFT STRUCTURAL INTERACTION**
A. Curnier Paris ESA Nov. 1980 43 p refs Revised
(Contract ESTEC-4315/80/NL-AK(SC))
(ED-80-295; ESA-CR(P)-1837) Avail: NTIS HC A03/MF A01

The accuracy of interface variants of the modal synthesis method is assessed. Spacecraft load prediction techniques are summarized. Spacecraft design charts are discussed. Although the loaded interface variant is more accurate, the fixed interface variant is much simpler. Modal synthesis is cruder than the transient finite element method, but it reduces the amount and inhomogeneity of information transmitted between launcher and spacecraft if the truncation level is high. Author (ESA)

**N84-21502#** Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).

**MISSILE SYSTEM: SIMULATION AND VALIDATION**
Roland Gauggel *In* AGARD AGARD Highlights, Mar. 1984 Mar. 1984 p 40-53 ref (For primary document see N84-21498 12-01)
Avail: NTIS HC A04/MF A01

**N84-21576#** Joint Publications Research Service, Arlington, Va.
**ASTRON SATELLITE**
V. A. Kotelnikov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 31-33 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow), no. 4, Jul. - Aug. 1983 p 2-3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

**N84-21577#** Joint Publications Research Service, Arlington, Va.
**RESEARCH CONTINUES WITH INTERCOSMOS-BOLGARIYA-1300 SATELLITE**
V. Adasko, V. Balebanov, and K. Serafimov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 34-36 Transl. into ENGLISH from Pravda (Moscow), 2 Sep. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

**N84-21579#** Joint Publications Research Service, Arlington, Va.
**DESIGN MODIFICATIONS ON VENERA-15, -16**
B. Konovalov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 46-48 Transl. into ENGLISH from Izv. (Moscow), 21 Oct. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

**N84-21583#** Joint Publications Research Service, Arlington, Va.
**FORECASTING SATELLITE MOTION**
Yuiry Alekseyevich Lukyanov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 66-68 Transl. into ENGLISH from Aviats. i Kosmonavtika (Moscow), no. 5, May 1983 p 44-45 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

**N84-21585#** Joint Publications Research Service, Arlington, Va.
**LIST OF RECENT SOVIET SPACE LAUNCHES**
*In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 88-89 Transl. into ENGLISH from Tass (Moscow) (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

# 16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

**N84-21606*#** Boeing Military Airplane Development, Wichita, Kans.
**DYNAMIC ASSESSMENT OF B-52B-008 CARRIER AIRCRAFT FOR THE REVISED SPACE SHUTTLE SOLID ROCKET BOOSTER DECELERATOR SUBSYSTEM DROP TEST VEHICLE**
Leslie J. Doty 16 Dec. 1983 53 p refs
(Contract NAS8-35016)
(NASA-CR-170989; NAS 1.26:170989; D500-10379-1) Avail: NTIS HC A04/MF A01 CSCL 22B

The structural integrity of B-52B-008, pylon, and hooks for the drop test missions was determined by theoretical analysis. The results of the analysis and conclusions are presented in this document. The major modification to the drop test vehicle was shortening it about 54 inches, which resulted in the forward hook attach structure being located at the base of the nosecone. The shims that are located in the aft hook structures are increased from two inches to three inches. Airspeed, aerodynamic configuration, and load charts are included. M.A.C.

# 17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

No abstracts in this category.

# 18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

**N84-21607*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**TETHERS IN SPACE: BIRTH AND GROWTH OF A NEW AVENUE TO SPACE UTILIZATION**
Georg vonTiesenhausen Feb. 1984 33 p refs
(NASA-TM-82571; NAS 1.15:82571) Avail: NTIS HC A03/MF A01 CSCL 22B

The evolution of the ideas of tether applications in space are traced from its origin in the last century past a dormant period of sixty-five years to the mid-seventies. At that time as a consequence of major revival efforts, NASA entered into serious investigations of the theoretical and practical feasibility of a large number of tethered concepts in space. These efforts culminated in the establishment of the Tethered Satellite System Project now at NASA in the advanced development phase. Extensive planning efforts are described, first, through a Tether Applications in Space Workshop which generated additional concepts and provided overall assessments and recommendations to NASA, and then through a NASA inter-center Tether Applications in Space Task Group which generated a four year program plan in the areas of further studies, technology, work and science and applications of tethers in space. An outlook into the future of tether applications that approaches some of the goals of the early visionaries is offered. Author

**N84-21608*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**OPERATIONAL MODULES FOR SPACE STATION CONSTRUCTION**
L. Robert Jackson, Paul L. Moses (Kentron International, Inc.), Stephen J. Scott (Kentron International, Inc.), and Max L. Blosser Apr. 1984 34 p refs
(NASA-TM-85772; NAS 1.15:85772) Avail: NTIS HC A03/MF A01 CSCL 22B

Identification of an effective space construction concept is a current objective of NASA studies. One concept, described in this memorandum, consists of repetitive use of operational modules, which minimizes on-orbit stay time for the shuttle. A space station constructed of operational modules may benefit from fabrication and system checkout in ground-based facilities, and since the modules are the primary structure of the space station, a minimum of additional structure, and trips and on-orbit stay time of the shuttle are required. Author

**N84-21609*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**RESULTS OF THE 1983 NASA/JPL BALLOON FLIGHT SOLAR CELL CALIBRATION PROGRAM**

R. G. Downing and R. S. Weiss 1 Feb. 1984 17 p refs
(Contract NAS7-100)
(NASA-CR-173465; JPL-Pub-83-100; NAS 1.26:173465) Avail: NTIS HC A02/MF A01 CSCL 22B

The 1983 solar cell calibration balloon flight was successfully completed and met all objectives of the program. Thirty-four modules were carried to an altitude of 36.0 kilometers. The calibrated cells can now be used as reference standards in simulator testing of cells and arrays. Cell calibration data are tabulated as well as the repeatability of standard solar cell BFS-17A (35 flights over a 21-year period). A.R.H.

**N84-21610*#** Rohr Industries, Inc., Chula Vista, Calif.
**RE-DESIGN AND FABRICATION OF TITANIUM MULTI-WALL THERMAL PROTECTION SYSTEM (TPS) TEST PANELS Interim Report**
W. Blair, J. E. Meaney, Jr., and H. A. Rosenthal Hampton, Va. NASA. Langley Research Center Jan. 1984 105 p refs
(Contract NAS1-15646)
(NASA-CR-172247; NAS 1.26:172247) Avail: NTIS HC A06/MF A01 CSCL 22B

The Titanium Multi-wall Thermal Protection System (TIPS) panel was re-designed to incorporate Ti-6-2-4-2 outer sheets for the hot surface, ninety degree side closures for ease of construction and through panel fastness for ease of panel removal. Thermal and structural tests were performed to verify the design. Twenty-five panels were fabricated and delivered to NASA for evaluation at Langley Research Center and Johnson Space Center. Author

**N84-21611#** Consulenze Generali Roma (Italy).
**STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 2: PROPOSALS FOR ADDITIONS, MODIFICATIONS AND NEW ANALYTICAL METHODS, VOLUME 1 Final Report**
Carlo Arduini and Ugo Ponzi Paris ESA Dec. 1982 360 p refs 5 Vol.
(Contract ESTEC-4348/80/NL-AK(SC))
(ESA-CR(P)-1779-Vol-3) Avail: NTIS HC A16/MF A01

For large space structure design, solution of the dynamic problems of the periodic structures by cyclosymmetric technique is discussed. Computing radiation forces by adapting thermal design verification softwares is considered. Simplified models and computational schemes for the aerodynamic load are outlined. Finite element formulations for tensioned members are evaluated. For individual titles, see N84-21612 through N84-21615.

**N84-21612#** Consulenze Generali Roma (Italy).
**THE SOLUTION OF THE DYNAMIC PROBLEM OF THE PERIODIC STRUCTURES BY CYCLOSYMMETRIC TECHNIQUE Final Report**
Carlo Arduini *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 1 Dec. 1982 p 13-168 refs (For primary document see N84-21611 12-18)
Avail: NTIS HC A16/MF A01

The cyclosymmetric approach is advocated for the large space structure eigenvalue problem. The method treats noncyclosymmetric systems as perturbations of a basic cyclosymmetric system. Noncyclosymmetry is assumed to reside in the boundary conditions only. The original set of equations is reduced to a formally cyclosymmetric system by including all the deviations in the load vector (F). All the unknowns are obtained as functions of F, but since F also depends on the unknowns, the solution is really a reformulation of the problem. System cyclosymmetry is estimated a posteriori by comparing its modal shapes to those of the cyclosymmetric boundary conditions. The method is particularly good for higher frequency modes, but also gives good results for frequencies as low as the fundamental, and for any number of bays. It can be applied to multisymmetric systems. Author (ESA)

**N84-21613#** Consulenze Generali Roma (Italy).
**COMPUTING THE RADIATION PRESSURE FORCES BY ADAPTING THERMAL DESIGN VERIFICATION SOFTWARES Final Report**
Carlo Arduini *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications, and New Anal. Methods, Vol. 1 Dec. 1982 p 169-208 (For primary document see N84-21611 12-18)
Avail: NTIS HC A16/MF A01

Formulas for computing radiation forces on large space structures are provided, and insertion of the formulas in thermal softwares is indicated. Radiation coming directly from the Sun or Earth, and direct reflection of this impinging radiation are considered. Except for thermal radiation, all cases can be covered by a single program run, and with a model limited to the spacecraft external surfaces. Formulas for general reflected flux distribution are generated. The formulas are specialized for diffuse, specular, and specular-diffuse reflection. Applications for Sun primary reflection are treated. Author (ESA)

**N84-21614#** Consulenze Generali Roma (Italy).
**SIMPLIFIED MODELS AND COMPUTATIONAL SCHEMES OF THE AERODYNAMIC LOAD**
Ugo Ponzi *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 1 Dec. 1982 p 209-276 refs (For primary document see N84-21611 12-18)
Avail: NTIS HC A16/MF A01

A scheme for computing the aerodynamic load on large space structures during the preliminary design phase is outlined. The scheme is based on simplified interaction models able to reduce the aerodynamic aspect of the problem into a simple form with a reasonable accuracy; and the adaptation and/or use of existing softwares in order to solve the geometrical implications. The Lockheed orbital heat rate program, the Thermal Radiation Analysis System program, and the Simplified Shuttle Payload Thermal Analyzer are described. Author (ESA)

**N84-21615#** Consulenze Generali Roma (Italy).
**FINITE ELEMENT FORMULATIONS FOR TENSIONED MEMBERS**
Silvano Sgubini *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 1 Dec. 1982 p 277-360 refs (For primary document see N84-21611 12-18)
Avail: NTIS HC A16/MF A01

The geometrical stiffness matrices are evaluated for typical structures, and the effects of shear deformations and rotary inertia on large space structure design are discussed. In plane and longitudinal deformations, and beam torque moment coupling with all other displacements are considered. Analysis shows that these effects are small, but not negligible. Evaluation of the geometrical stiffness matrix of a square section beam reveals that axial and shear force effects can be of the same order of magnitude with slender beams. Author (ESA)

**N84-21616#** Consulenze Generali Roma (Italy).
**STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 2: PROPOSALS FOR ADDITIONS, MODIFICATIONS AND NEW ANALYTICAL METHODS, VOLUME 2 Final Report**
Carlo Anduini and Ugo Ponzi Paris ESA Dec. 1982 368 p refs 5 Vol.
(Contract ESTEC-4348/80/NL-AK(SC))
(ESA-CR(P)-1779-Vol-4) Avail: NTIS HC A16/MF A01

Thermal design verification of large open truss structures of large spacecraft (the local approach and the shadow problem); computational savings in view factor evaluation by node prescreening; analytical formulations of the interactive structural thermal control problem (thermostructural self excitation); and design oriented control theories in continuous models are discussed. For individual titles, see N84-21617 through N84-21619.

**N84-21617#** Consulenze Generali Roma (Italy).
**THERMAL DESIGN VERIFICATION OF THE LARGE OPEN TRUSS STRUCTURES. THE LOCAL APPROACH AND THE**

**SHADOW PROBLEM Final Report**
Carlo Arduini *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 2 Dec. 1982 p 13-120 refs (For primary document see N84-21616 12-18)
Avail: NTIS HC A16/MF A01

For large space structure thermal design verification, an approximation which considers a single bay (or a module made by a finite number of bays) as isolated from the rest of the system (the "local" approach) was suggested. Conditions under which the approximation is acceptable; and expressing heat input to the isolated bay, while not considering all the complex shadow effects of the complete system, are discussed. Analysis shows that the local approach causes appreciable errors only at the boundaries, and considerably reduces computational loads. The method can also be applied when both trusses and finite bodies are present. For these systems an iterative scheme which solves in one step the system of the main bodies only (taking truss temperatures to be known) and in a successive step solves the truss, using the local approach (taking main body temperature as known) is proposed. Author (ESA)

**N84-21618#** Consulenze Generali Roma (Italy).
**COMPUTATIONAL SAVINGS IN VIEW FACTOR EVALUATION ON MODE PRESCREENING Final Report**
Silvano Sgubini and Carlo Arduini *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 2 Dec. 1982 p 121-170 refs (For primary document see N84-21616 12-18)
Avail: NTIS HC A16/MF A01

Criteria for reducing the number of view factors of each node with respect to the surroundings to the absolute minimum compatible with a prescribed accuracy for large space structures thermal design verification; and minimizing the number of elements required per node for a given accuracy are discussed. A multiple screening technique, using the Simplified Shuttle Payload Thermal Analyzer (SSPTA) program, is investigated. The SSPTA contains a mixed surface-contour integral type view factor routine. Additional surfaces can be screened out after the shadow check, if a substantial blockage is detected. Computation of view factors among the remaining nodes can be effected, after the appropriate number of elements in the node is selected, in agreement with the desired accuracy. It is shown that this procedure can drastically reduce the total number of elements in large systems, being equivalent, from the radiative point of view only, to a local approach, without however any arbitrary substructure isolation. Author (ESA)

**N84-21619#** Consulenze Generali Roma (Italy).
**INTERACTIVE STRUCTURAL-THERMAL-CONTROL ANALYTICAL FORMULATIONS Final Report**
Carlo Arduini *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 2 Dec. 1982 p 171-368 refs (For primary document see N84-21616 12-18)
Avail: NTIS HC A16/MF A01

The suitability of analytic solutions for large space structure interactive thermal control dynamic problems was studied for the case of a beam subjected to the thermal environment of space, and possibly actively controlled by sensors and actuators. It is shown that the basic interactive equations can be constructed in a variety of conditions based on a menu of component terms derived from basic theories and limited special developments, such as a thermal theory of the beam. The approach is limited, however, to considering a fixed, generally simple, geometry, although the size can be increased by adding modes without changing the reduced size model. Author (ESA)

**N84-21620#** Consulenze Generali Roma (Italy).
**STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 3: EXPERIMENTAL DESIGN VERIFICATION TECHNIQUES Final Report**
Carlo Arduini and Ugo Ponzi Paris ESA Dec. 1982 428 p refs 5 Vol.
(Contract ESTEC-4348/80/NL-AK(SC))
(ESA-CR(P)-1779-Vol-5) Avail: NTIS HC A19/MF A01

Ground and flight tests of large space structures are discussed. Thermal balance tests, thermal cycle tests, the effects of scale reductions, and gravitational effects are considered. Static, dynamic, and modal structural analysis techniques are reviewed. For individual titles, see N84-21621 through N84-21623.

**N84-21621#** Consulenze Generali Roma (Italy).
**ASSESSMENT OF THE EXISTING GROUND TEST TECHNOLOGY AND CONFRONTING WITH THE LARGE SPACE STRUCTURES (LSS) REQUIREMENTS. EXPERIMENTAL TECHNIQUES IN STRUCTURAL ANALYSIS**
Ugo Ponzi and Alessandro Agneni *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 3: Expt. Design Verification Tech. Dec. 1982 p 13-103 refs (For primary document see N84-21620 12-18)
Avail: NTIS HC A19/MF A01

Static, dynamic and modal structural analysis of large space structures (LSS) on ground are discussed. Standard excitation tests, and the effect of the surrounding fluid in vibration are reviewed. For LSS ground testing, constraints due to the large size; to the peculiar physics of the problem; and originating from the Earth environment are the most important. These constraints act in general all together, so that the effect of one factor is exasperated by the presence of the remaining ones. The combination size-gravity is the most significant example. Size constraints are best tackled by partial model methods for static tests and reconstruction of the behavior of the entire system by modal synthesis for dynamic tests. Investigation of physics related constraints is severely limited by scarcity of data on large configurations. Earth environment effects can be assessed by comparing the effect, e.g., gravity with each experimental parameter. Author (ESA)

**N84-21622#** Consulenze Generali Roma (Italy).
**ASSESSMENT OF THE EXISTING GROUND TEST TECHNOLOGY AND CONFRONTING WITH THE LARGE SPACE STRUCTURES (LSS) REQUIREMENTS. THERMAL TEST TECHNIQUES**
Ugo Ponzi *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 3: Expt. Design Verification Tech. Dec. 1982 p 104-169 refs (For primary document see N84-21620 12-18)
Avail: NTIS HC A19/MF A01

Thermal balance and thermal cycle ground testing of large space structures is reviewed. Scale reduction is identified as the major problem. For the combined dynamical - radiation - thermal - structural problem, no length-scaling appears possible. For the combined radiation - thermal - structural problem (statistically distorting structures) slight length-scaling is possible. For uncoupled radiation - distortion, full length-scaling is possible. Simulation methods and facilities for solar radiation characteristics; albedo and Earth radiation; vacuum; heat sink; and spacecraft mounting are reviewed. Author (ESA)

**N84-21623#** Consulenze Generali Roma (Italy).
**PROPOSALS FOR ADDITIONS, MODIFICATIONS, AND NEW EXPERIMENTAL METHODS. PART 1: GROUND TESTS. PART 2: FLIGHT TESTS**
Ugo Ponzi *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 3: Expt. Design Verification Tech. Dec. 1982 p 170-428 refs (For primary document see N84-21620 12-18)
Avail: NTIS HC A19/MF A01

The adaptation of ground test techniques to analysis of large space structures (LSS) is discussed using Space Construction Automated Fabrication Experiment Definition Study data. Analysis of gravitational effects is emphasized, and the difficulties and practical consequences in reducing scale when composite materials are involved are considered. The evolution of flight tests from aircraft to space applications is reviewed. Modeling of LSS is

treated. Parameter identification approaches are compared with methods which consider the model/system performance/error problem as a whole. Identification algorithms and error representations are appended. Author (ESA)

**N84-21624#** Consulenze Generali Roma (Italy).
**STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 1: ASSESSMENT OF DESIGN VERIFICATION ANALYTICAL METHODS. VOLUME 1: MECHANICAL DESIGN Final Report**
Carlo Arduini and Ugo Ponzi Paris ESA Dec. 1982 480 p refs 5 Vol.
(Contract ESTEC-4348/80/NL-AK(SC))
(ESA-CR(P)-1779-Vol-1) Avail: NTIS HC A21/MF A01

Softwares for large spacecraft structural dynamic/control dynamic verification are reviewed. The ASKA, NASTRAN, SPAR, DISCOS, and N-BOD programs are described. Decoupling, substructuring, and the effects of structural symmetry are discussed. For mechanical design verification, orbital flight conditions replace launch stresses tolerance as the main criterion. For thermal design, verifying thermal deformations is paramount for large space structures. Software for design verification of these structures should integrate thermal and mechanical parameters into an interactive scheme. Author (ESA)

**N84-21625#** Consulenze Generali Roma (Italy).
**STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 1: ASSESSMENT OF DESIGN VERIFICATION ANALYTICAL METHODS. VOLUME 2: THERMAL DESIGN Final Report**
Carlo Arduini and Ugo Ponzi Paris ESA Dec. 1983 411 p refs 5 Vol.
(Contract ESTEC-4348/80/NL-AL(SC))
(ESA-CR(P)-1779-Vol-2) Avail: NTIS HC A18/MF A01

Thermal design verification of large space systems through software evaluation was studied. The analytical methods were summarized with special emphasis on the Lockheed orbital heat rate package, the thermal radiation analysis system, NASTRAN thermal analyzer, and the simplified shuttle payload thermal analyzer. Basic concepts of thermodynamic modeling and structural characteristics were included along with the relevant equilibrium equations. M.A.C.

**N84-21626#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
**DEVELOPMENT OF PROCEDURES FOR COMPONENT MODE SYNTHESIS Final Report**
A. Bertram and P. Conrad Paris ESA 15 Mar. 1983 163 p refs
(Contracts ESTEC-4350/80/NL-PP; DFVLR-232-11; DFVLR-3-719-101)
(DFVLR-IB-232-82-C-09; ESA-CR(P)-1826) Avail: NTIS HC A08/MF A01

The requirements of a rational, cost effective component mode synthesis were established by performing modal coupling analyses on a spacecraft model composed of two modules with a highly redundant interface. Parameter studies defined criteria for the selection of the most suitable mode sets, the definition of boundary conditions, the number of modes and the accuracy of the mathematical mass model. Finite element models of the actual structure were used. The studies reveal the dynamic behavior of a structure with complicated interfaces, and enable optimum test boundary conditions to be defined. Author (ESA)

**N84-21627#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**THE INTRODUCTION OF CLAMPBANDS IN SPACECRAFT STRUCTURAL MATHEMATICAL MODELS Final Report**
B. Caesar and F. Vogel Paris ESA Mar. 1983 55 p
(Contract ESTEC-5099/82/NL-PB(SC))
(EMSB-12/83; ESA-CR(P)-1830) Avail: NTIS HC A04/MF A01

Ariane and Thor Delta spacecraft adapter and clamp band stiffnesses are described, and simplified mathematical methods for investigating the influence of adapter and clamp band stiffnesses on the eigenfrequencies of spacecraft are presented. Methods of introducing clamp band and adapter stiffnesses in a finite element model are described. Modal coupling methods are illustrated using Giotto test data to show which data should be measured during a modal survey test to investigate the influence of adapter and clamp band stiffnesses on the modes and eigenfrequencies. The influence of pretension on clamp band mechanical properties is discussed. Author (ESA)

**N84-21584#** Joint Publications Research Service, Arlington, Va.
**BENEFITS FROM SATELLITE PROGRAMS CITED**
B. Konovalov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 73-77 Transl. into ENGLISH from Izv. (Moscow), 1 Sep. 1983 p 3 (For primary document see N84-21566 12-12) Avail: NTIS HC A05

# 19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

**N84-21628#** Officine Galileo S.p.A., Florence (Italy).
**STUDY OF ADVANCED SIGNAL PROCESSING AND CALIBRATION FOR IRES (INFRARED SENSORS) Final Report**
Roberta Baldassini Fontana, Stefano Bartoloni, Roberto Casini, and Lido Cecconi Paris ESA Jan. 1982 183 p
(Contract ESTEC-4327/80/NL-AK(SC))
(Rept-458-DT-5; ESA-CR(P)-1847) Avail: NTIS HC A09/MF A01

A mathematical model of three axis stabilized geostationary satellite infrared sensor performance was developed and was used to assess signal processing techniques. The model includes nonuniform responsivity bolometer; general electronics transfer function; geometrical mounting; signal processing; Keplerian orbit definition; no dynamic motion; and Earth radiance variations with season, latitude, longitude, and profiles at Earth edge. Results show that signal processing based on low frequency band concepts present no advantages for European Communication Satellite type configurations. A derivator based technique is recommended. Author (ESA)

# 20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

**N84-21629#** Stuttgart Univ. (West Germany). Inst. fuer Raumfahrtantriebe.
**FIELD EMISSION ELECTRIC PROPULSION. FURTHER TESTING OF MERCURY AS PROPELLANT Final Report**
Paris ESA Sep. 1983 35 p
(Contract ESA-5090/82/NL-PB(SC))
(IRA-83-P-6; ESA-CR(P)-1829) Avail: NTIS HC A03/MF A01

Mercury propellant for a slit field emission thruster was studied by establishing an ignition condition theoretically. For a slit edge geometry, the edge radius of curvature does not influence the ignition voltage as expected. The ignition voltage is proportional to the root of the surface tension of the propellant material. The estimated high ignition voltage (23 kV) with mercury is verified experimentally. Voltage-current characteristics were measured. Increasing emission is recognized as an increasing number of equidistant Taylor-cone emitting sites along the slit. Author (ESA)

**N84-21630#** Engineering System International, Rungis (France).
**SURVEY OF TECHNIQUES EMPLOYED IN THE ANALYSIS OF ROCKET MOTOR SOLID PROPELLANTS**
J. Dubois Paris ESA Nov. 1980 75 p refs
(Contract ESTEC-4316/80/NL-AK(SC))
(ED-80-292; ESA-CR(P)-1836) Avail: NTIS HC A04/MF A01

Numerical techniques employed in the analysis of rocket motor solid propellants under thermal loads; dynamic behavior under ground handling, transportation and flight environmental conditions; and pressurization load are reviewed. The constitutive behavior of the solid propellants, and elastic, thermoviscoelastic, and thermoviscoplastic models are discussed. Author (ESA)

# 23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

**N84-21631#** Department of Energy, Washington, D. C. Office of Basic Energy Sciences.
**CRITICAL AND STRATEGIC MATERIALS: PROCEEDINGS OF THE LABORATORY STUDY GROUP MEETING**
Jun. 1983 196 p Meeting held in Idaho Falls, Idaho, 12-13 Apr. 1983
(CONF-830474) Avail: NTIS HC A09/MF A01

The appropriate role for DOE's Basic Energy Sciences, Divisions of Materials Sciences Laboratory concerning critical and strategic materials was identified as well as high priority target areas and the research, expertise, and resources that are available. Predicative solid state theory is considered for guidance in experimental research on alternative or substitute materials (alloys, ceramics, polymers, surfaces, amorphous materials, and inhomogeneous materials). Advanced processes for modifying materials behavior discussed include surface modification; rapid solidification and related nonequilibrium bulk powder formation; coating processes; interfaces; and methods for materials synthesis. Bulk substitution research with metallic, ceramic, and polymer "alloys" to displace frequently used critical and strategic materials is examined and plans of laboratories and collaborative research centers are highlighted. A.R.H.

**N84-21632#** Office of Naval Research Liason Office, Far East, APO, San Francisco, Calif.
**ONR (OFFICE OF NAVAL RESEARCH) FAR EAST SCIENTIFIC BULLETIN, VOLUME 8, NO. 4, OCTOBER - DECEMBER 1983**
Mary Lou Moore, ed. Dec. 1983 140 p
(AD-A138184) Avail: NTIS HC A07/MF A01 CSCL 05/2

Recent developments in research in the Far East are discussed. Robotics, metal powders, and electrochemistry are among the topics discussed. R.J.F.

**N84-21633#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: MATERIALS SCIENCE AND METALLURGY**
28 Feb. 1984 54 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-84-001) Avail: NTIS HC A04/MF A01

This U.S.S.R. report on materials science and metallurgy covers a wide range of research initiatives. Topics of interest covered includes: aluminum and its alloys; composite materials; energy effects; ferrous and powder metallurgy; minerals; mechanical properties and welding. For individual titles, see N84-21634 through N84-21662.

**N84-21634#** Joint Publications Research Service, Arlington, Va.
**MICROSTRUCTURE OF ALUMINUM ALLOY IN EARLY STAGES OF SPALLING Abstract Only** **c26**
V. I. Romanchenko, O. I. Marusiy, and I. V. Kramarenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 1 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 84-87 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Characteristic features of spalling fracture in response to a rapid pulsed load are described. The microstructure of type V95 aluminum alloy was studied in sections cut from the central portion of the disk shaped target 15 mm thick subjected to flat impact by a plate of the same material at a speed of 155 to 270 m/s, leading to various stages of spalling. Cylindrical specimens were cut from impacted targets and tested on an Instron machine, changes in residual strength at a tensile testing speed of 1 mm/min were recorded as a function of impact velocity. Photomicrographs of cracks and shear deformations at crack tips illustrate the successive stages in failure of the aluminum alloys upon high velocity impact. Spalling is found to be viscous in nature, with localized shear deformation in the stage of formation of major cracks an important process, its mechanism largely determined by the initial directed structure of the alloy. Author

**N84-21635#** Joint Publications Research Service, Arlington, Va.
**FRACTURE OF ALUMINUM IN UNIAXIAL AND BIAXIAL EXTENSION AT 473-77 DEG K Abstract Only** **c26**
I. Ye. Kurov, N. N. Demikhovskaya, G. I. Shakhalova, and S. M. Shevchenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 1-2 Transl. into ENGLISH from Fiz. Metallov i Metalloved. (Sverdlovsk, USSR), v. 56, no. 3, Sep. 1983 p 593-599 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

A study is made of the temperature time variation of strength of aluminum with simultaneous observation of the development of deformation and structural changes over a broad temperature interval with both uniaxial and biaxial extension in order to determine the mechanism controlling failure under these conditions. Durability test data were used to calculate the activation energies of structure. X-ray diffraction studies and transmission electron microscopy were used to determine the dislocation structure of deformed specimens, and fractographic analysis of fracture zones was performed. Studies were performed on type A-7 99.7% aluminum foil 0.1 mm thick. For biaxial extension the deformation to rupture epsilon sub k throughout the entire range of change of external conditions is constant, whereas under uniaxial extension at 77 K greater deformation is accumulated by the moment of fracture than at moderate temperatures. The results of fractographic analysis indicate that in all cases the fracture is viscous in nature. At moderate temperatures and uniaxial extension there is no local thinning of the foil, and the fracture surface is flat with numerous furrows almost parallel to the line of intersection of the fracture surface and the side surface of the specimen. B.W.

**N84-21636#** Joint Publications Research Service, Arlington, Va.
**FEATURES OF PHYSIOCHEMICAL REACTION IN ALUMINUM-BORON COMPOSITE MATERIAL Abstract Only** **c24**
V. S. Postnikov, V. I. Lavrentyev, and M. Kh. Shorshorov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 3 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow), no. 5, Sep. - Oct. 1983 p 96-99 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Little study has been made of reactions in composite materials where an oxide film is preserved at the boundary between matrix and reinforcing material. The present study considers the promising combination of aluminum and boron fibers for reinforcement by a dynamic module of elasticity method and micro-X-ray spectral analysis. The proportion of fiber to matrix was determined optically. Results showed that increases in the dynamic module of elasticity were related to the increase in the high modular intermetallic compound AlB2, which was preceded by an incubation period for forming new phase nuclei. While the method outlined has value, its drawbacks include measurement of only one side of the growth at the intermetallide's boundary. Rate of motion in laminate layers is also measured, showing that the tensions that develop are significantly less in an aluminum boron system than in a titanium boron counterpart. Author

**N84-21637#** Joint Publications Research Service, Arlington, Va.
**REINFORCING MATERIALS BASED ON MAGNESIUM OXIDE Abstract Only** **c24**
D. Karpinos, V. M. Groseheva, V. N. Morozova, V. P. Dzeganovskiy, Yu. I. Morozov, and K. I. Yakovlev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 3-4 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow), no. 5, Sep. - Oct. 1983 p 93-95 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Broad use of magnesium oxide ceramic material for construction is hampered by its brittleness and low heat resistance. The present study considers composite materials for reinforcing this ceramic using hot pressing, in which the liquid mass does not damage the reinforcing fibers. The matrix used consisted of magnesium oxide powder with particle size of 0.3 mkm, and the fibers were made of tungsten and molybdenum. A maximum of 15% reinforcing material was established. The resulting product had slightly less flexibility than pure MgO ceramics, but impact strength grew in proportion to the content of fibers, with better results when molybdenum was used. Little reaction between fibers and matrix was noted. Thermal durability increased in proportion to the percentage of fibers added, up to the 15% maximum.
Author

**N84-21638#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF CONCENTRATED ENERGY STREAMS ON MATERIALS: PROBLEMS AND PROSPECTS Abstract Only**
N. N. Rykalin and A. A. Uglov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 5 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow), no. 5, Sep. - Oct. 1983 p 3-18 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Use of concentrated energy streams composed of electrons, ions, low temperature plasma or laser beams, are finding numerous physical and physico-chemical applications. The present review covers processes of heat and mass transfer as well as certain applications. heating and cooling of bodies, as outlined in mathematical models that consider thermophysical coefficients of substances, are described more precisely with nonlinear than with linear calculations. Surface melting, especially with lasers, has promise for precision welding. Ablation and vaporization are described in thermal models. Hydrodynamics involved in fusion movement at surface layers and in melt baths are also presented. Autovibration of energy streams is important to determine thicknesses of layers in compositions. The nature and pressure of the surrounding environment provides another factor in controlling these processes, but instability remains a problem to be surmounted. Physical experiments are being used to perfect mathematical models. Applications include thermal processing and tampering, welding, cutting, various metallurgical procedures and numerous processes for porous materials. Computerized monitoring and production control are being advanced.
Author

**N84-21639#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF ELECTRON IRRADIATION ON RELAXATION OF TENSION IN ALUMINUM AND ALUMINUM ALLOYS Abstract Only** **c26**
L. N. Bystrov and M. Ye. Reznitskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 5-6 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow), no. 5, Sep. - Oct. 1983 p 89-92 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Study of relaxation in metals and alloys during irradiation is an important issue in radiation research, since that process determines a material's capability to maintain a given level of tension for design applications. Common studies based on internal friction during deformation do not provide sufficient accuracy. The authors considered cold deformed and annealed pure metals and alloys on a device permitting deformation of a flat sample by torsion and maintenance of the deformed state throughout the test. Metals tested were pure aluminum and an aluminum alloy with 0.04% Mn, the latter being both cold deformed and annealed at 300 C for 2 hours. Thermal and radiation stimulated relaxation measurements were recorded. Results showed that the most rapid relaxation took place in the pure aluminum, followed by the cold deformed alloy. The annealed alloy was more resistant. Relaxation was speeded in the first and last by irradiation, while in the cold deformed alloy at low temperatures rapid relaxation occurred as in pure aluminum, and with high temperature (approaching 100 C), it was retarded.
Author

**N84-21640#** Joint Publications Research Service, Arlington, Va.
**SPECIFICS OF STRUCTURE FORMATION IN NITRIDES SYNTHESIZED BY LASER ACTION ON METALS Abstract Only** **c26**
N. N. Rykalin, A. A. Uglov, V. A. Grebennikov, and M. B. Ignatyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 6 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 272, no. 5, Oct. 1983 p 1110-1114 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

For the first time a relationship has been experimentally established between auto-oscillating processes in a near surface laser plasma and the formation of a nitride structure on the surface of the metal. The influence of radiation conditions and the method of feeding of nitrogen to the target on the structure and properties of nitride compounds synthesized on the surface of refractory metals is also determined. The radiation of a neodymium laser with a flux density of 10 to the 5th power -10 to the 7th power w/sq cm, pulse length 1 ms, was focused on the surface of specimens of cast type VTI-0 titanium, with nitrogen fed to the surface from a jet nozzle coaxially with the laser beam at 1 to 80 m/s or with the specimen in a nitrogen chamber with a pressure of 1 to 100 atm. X-ray structural analysis revealed that in both cases a nitride was formed on the titanium surface, the nitrogen content of which depended on the processing conditions. Metallographic studies revealed differences in the structures of the experimental areas resulting from the parameters of the process. The kinetics of the phenomena occurring in the process are briefly discussed.
B.W.

**N84-21641#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF AGING IN MARTENSITE STATE ON MECHANICAL PROPERTIES OF Cu-Al-Zn SYSTEM BETA-ALLOY Abstract Only** **c26**
O. G. Zotov, S. Yu. Kondratyev, G. Ya. Yaroslavskiy, B. S. Chaykovskiy, and V. V. Matveyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 21 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 81-83 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

A study is made of the thermokinetic variation in mechanical properties of high damping beta alloy in the system Cu-Al-Zn in the process of aging at temperatures below the beginning of the reverse martensite transformation (A sub n). An alloy with a composition of Cu+8.7 mass % Al+12.7 mass % Zn was produced in an induction furnace under cryolite, annealed at 500 C and quenched in water from 700 C, then aged at 300 and 400 C for 2 to 120 minutes. Mechanical properties were determined by the standard methods, including tensile testing and impact bend testing. Aging was found to have a multistage nature, leading to a nonmonotonic and complex change in mechanical properties. By varying the aging conditions in the martensite temperature area it is possible to significantly increase the strength of hardened single phase beta alloys without decreasing ductility.
Author

**N84-21642#** Joint Publications Research Service, Arlington, Va.
**PROGRAM FOR PROCESSING RAW MATERIALS**
*In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 22-26 Transl. into ENGLISH from Ekon. Gazeta (Moscow), no. 38, Sep. 1983 p 2 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Mining branches annually deliver more than 15 billion tons of mineral raw materials, including more than 1.5 billion tons of ores headed for concentration, to the national economy. In connection with the constant trend of reducing the content of metals in ores and increasing the needs of the national economy, the mining capacity has been doubled every ten years. The current five year plan for the development of progressive industrial processes and equipment for mining is described. Ore deposits of ferrous metals, as a rule, have large dimensions in area and comparatively low bedding depth. This circumstance makes it possible to mine such deposits by the open pit method, using high capacity drilling, mining transport and loading equipment. An example of this can be the Kursk Magnetic Anomaly or KMA. The mining of ores of ferrous metals by the open pit method has increased from 71.2% in 1965 to 86% in 1982. Subsequently, a considerable change with respect to underground mining has not been proposed. B.W.

**N84-21643#** Joint Publications Research Service, Arlington, Va.
**OBTAINING METALLIC POWDERS BY ULTRASONIC ATOMIZATION OF MELTS Abstract Only** **c26**
Sh. M. Sheykhaliyev and S. I. Popel *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 27 Transl. into ENGLISH from Poroshkovay Met. (Kiev), no. 10, Oct. 1983 p 18-24 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

While some applications have been made of ultrasonic processes for producing metallic and other powders with melting temperatures up to 1000 C, little is known about the processes governing this atomization. The authors studied design and technological features of ultrasonic atomization and assessed its effectiveness and the qualities of powdered metals obtained. The chamber they designed is diagrammed and described. The process involved forming a vacuum, filling the chamber with inert gas (argon or helium) and heating 30 to 50 C above melting point. Factors of choosing the atomizer system and the effects of thickness on powder dispersion and ultrasonic frequency are discussed. The authors assert that the intensity of atomization is the greatest if oscillation frequency of the concentrator focus and that of the melt coincide. Atomization is attributed to the breakdown of capillary ridges by ultrasonic waves. Particles are distinguished by great dispersion and homogeneity, spherical shape, yield and low oxygen content (less than 0.02%). Author

**N84-21644#** Joint Publications Research Service, Arlington, Va.
**EXPERIMENTAL STUDY OF POWDER PRODUCTION PROCESS USING CENTRIFUGAL ATOMIZATION Abstract Only** **c27**
A. G. Tsipunov, Yu. F. Ternovoy, S. B. Kuratchenko, and O. M. Kuimova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 27-28 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1983 p 13-18 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Temperature and power applications place high demands on powder nickel alloys. The present study reports on a special computer-regulated apparatus for centrifugal atomization that eliminates shortcomings of earlier methods; a distinguishing feature is the system for mixing a counterflow of argon or argon and helium, which facilitates breaking and cooling of metal particles. The vacuum system provides for up to 1 Pa of vacuum in the oven and atomization chambers, with residual gas pressure of up to 0.02 MPa. Production tests with feed of 0.5 kg/sec., atomizer diameter of 0.09-0.11 m, and 6,000 rpm, and counterflow of argon at 21-42 m/sec., provided granules largely in the range of 200-300 mkm. Results showed that small particles were spherical, but larger ones were irregular. The particles showed almost no gas porosity until dimensions surpassed 630 mkm. The particles were of cellular structure, and their oxygen content was the same as with other production procedures. Author

**N84-21645#** Joint Publications Research Service, Arlington, Va.
**OBTAINING TITANIUM CARBIDE POWDER FROM TITANIUM SHAVINGS Abstract Only** **c26**
S. S. Kiparisov, Yu. V. Levinskiy, O. V. Padalko, and A. P. Petrov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 28 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1983 p 24-28 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

The reprocessing of titanium waste, which often amounts to 1.5 times as much metal by weight as finished products, is crucial due to the metal's scarcity. The present study reports on a method for obtaining titanium carbide powder from titanium shavings and on optimum carbidization parameters. Original tests did not produce titanium carbide that approached stoichiometric parameters; consequently, further carbidization was conducted in a liquid-solid phase blend. A two-stage carbidization process was finally perfected, with vacuum of 0.013 Pa, and temperature of 1873 K for 1.5 hours, 2273 K for 0.5 hours, subsequent vibration milling for 0.5 hours and finally, 2273 K for 0.5 hours to complete processing. Oxygen content and other parameters exceeded previous domestic Soviet titanium carbide standards. Author

**N84-21646#** Joint Publications Research Service, Arlington, Va.
**NITRATION OF INTERMETALLIDE TiAl3** **c27**
O. V. Pshenichnaya, P. A. Verkhovodov, P. S. Kislyy, M. A. Kuzenkova, and A. B. Goncharuk *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 28-29 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1983 p 76-80 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Nitration of powder and compact titanium and aluminum separately has received considerable scholarly attention, but Ti-Al systems have not been studied. The present study reports on reactions of TiAl3 with nitrogen and ammonia in a quartz reactor at 600-1200 C with less than 0.003% oxygen. Below 900 C little nitration took place, but more intensive reaction was observed above that temperature, with the formation of new phases. Stable nitride phases AlN and TiN were joined in special conditions by Ti2AlN, a less stable system. Since the free energy of their formation was close, no selective nitration was observed; nor were noticeable reactions between phases recorded. The lack of close bonds and marked differences in coefficients of thermal expansion facilitated easy delamination of TiN, AlN and TiAl3 phases. Slower nitration with ammonia than with nitrogen was attributed to hydrogen atoms of the ammonia that hampered the penetration of nitrogen atoms into the metal system. The hydrogen was also much more closely fixed in titanium nitrido-hydrides than in hydrides. The TiAl3 structure consisted of isometric poly-hedral crystals of TiN of 100-200 nm interspersed among needle-like AlN crystals 100-700 nm in length. Author

**N84-21647#** Joint Publications Research Service, Arlington, Va.
**STRENGTH OF HARD ALLOY ELEMENTS OF HIGH PRESSURE APPARATUS FOR SYNTHESIS OF SUPERHARD MATERIALS Abstract Only** **c26**
N. V. Novikov, A. A. Lebedev, M. G. Loshak, V. M. Fridman, and V. S. Belinskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 30 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 58-64 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Results are presented from testing of tungsten hard alloys under high hydrostatic pressures. An experimental foundation is developed for the applicability of the corresponding strength criteria to these materials and, based on the results of calculation of the stress state in the most dangerous zones, strength reserve factors are established for an AVD hard alloy matrix for the synthesis of diamond. Tungsten hard alloys containing 6, 15 and 25 mass % cobalt were tested. The commercial designations of these alloys are VK6, VK15 and VK25. Standard circular specimens 4 mm diameter with gage length 12 mm were used for tensile testing. Cylindrical specimens 4 x 12 mm were used for compression testing. Specimens were manufactured by two-stage sintering, yielding satisfactory homogeneity in terms of content and structure soft carbon. Deformation curves in compression and in extension with hydrostatic pressure are presented, as well as curves

illustrating the variation in ultimate strength in compression and extension as a function of cobalt content for various levels of hydrostatic pressure. Analysis of compression and tensile test data shows that the stress intensity increases with increasing hydrostatic pressure. Author

**N84-21648#** Joint Publications Research Service, Arlington, Va.
**INTERRELATIONSHIP BETWEEN TEMPERATURE INTERVALS OF INVERSE MARTENSITE TRANSFORMATION AND SHAPE RESTORATION IN TITANIUM NICKELIDE-BASED ALLOYS Abstract Only** **c26**
N. F. Zhebyneva, D. B. Chernov, V. N. Khachin, and V. E. Gyunter *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 31 Transl. into ENGLISH from Fiz. Metallov i Metalloved. (Sverdlovsk, USSR), v. 56, no. 3, Sep. 1983 p 521-525 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

A study is presented of the interrelationship between the temperature intervals of the reverse martensite transformation and shape restoration (thermomechanical recovery) in titanium nickelide based alloys containing 51 to 57 wt.% Ni. Alloys were produced by arc melting with an infusible electrode. The primary method used to study the reverse martensite transformation was the method of differential thermal analysis, which can fix the temperature of the beginning and ending of the transformation with accuracy of 10 C. X-ray structural analysis was also performed in CuK alpha radiation at room temperature and up to 300 C. Shape restoration begins throughout the concentration interval studied at temperatures higher than the reverse martensite transformation, some 70 to 80 C higher for alloys containing up to 55 wt.% Ni, 20-40 C higher for alloys containing more nickel. To determine the influence of degree of preliminary deformation on the reverse matensite transformation interval, alloys of various composition were deformed by up to 4% in compression, while a number of alloys rich in titanium were deformed by up to 20% in compression. Author

**N84-21649#** Joint Publications Research Service, Arlington, Va.
**MARTENSITE TRANSFORMATION AND SHAPE MEMORY IN TI0.5NI0.5-XPd SUB X SYSTEM ALLOYS Abstract Only** **c26**
V. P. Sivokha, A. S. Savvinov, V. P. Voronin, and V. N. Khachin *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 32 Transl. into ENGLISH from Fiz. Metallov i Metalloved. (Sverdlovsk, USSR), v. 56, no. 3, Sep. 1983 p 542-546 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Alloys with the composition Ti0.5Ni0.5-xPdx, where x is 0 to 0.5, are used to study the regularities of formation of the martensite phase and manifestation of the shape memory effect. Particular attention is given to determination of the conditions of maximum manifestation of this effect. The structure was studied on a diffractometer in CuK alpha radiation. The structure of the martensite phases was determined by homology. The status of the crystalline lattice in the vicinity of the martensite conversion was judged from the behavior of the shear modulus. The peculiarities of accumulation and recovery of deformation with temperature and sequence of martensitic transformation were found to be directly related. The addition of palladium to titanium nickelide replacing some of the nickel causes a change in the sequence of martensitic transformation and a simultaneous change in shape-memory effect parameters. Optimal conditions for manifestation of the effect are obtained when the martensite transformations occur at anomolously low values of lattice elastic constants. R.J.F.

**N84-21650#** Joint Publications Research Service, Arlington, Va.
**FLUCTUATIONS IN CHEMICAL COMPOSITION OF TITANIUM ALLOY BETA-SOLID SOLUTION IN PRESEPARATION STAGE** **c26**
A. A. Alekseyev, O. S. Korobov, A. B. Notkin, L. A. Smolyakova, and A. D. Shestakov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 32-33 Transl. into ENGLISH from Fiz. Metallov i Metalloved. (Sverdlovsk, USSR), v. 56, no. 3, Sep. 1983 p 515-520 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

It is thought that before a titanium alloy-solid solution decomposes, areas rich and poor in the alloying elements develop in the volume of the solution. The formation of concentration heterogeneities can be explained by fluctuations in the placement of alloying element atoms at the nodes in the crystalline lattice. A mechanism for close order delamination of a beta-solid solution before the stage of precipitation requiring no diffusion restructuring of the alloying elements is developed. The method is developed by analysis of an unstable solid solution of Mo in beta-titanium at a temperature below the beta yields alpha phase transition, assuming that the atoms of Mo are chaotically located in the volume of the alloy. Fluctuations in chemical composition are always present in the beta-solid solution of titanium alloys. Their formation results from random placement of atoms in the crystalline lattice. The volumetric fraction of fluctuations does not change with time. After rapid cooling (quenching) nondiffusion phase transition may occur within the fluctuations, the volumetric fraction of fluctuations being sufficient to have significant influence on decomposition of the solid solution. R.J.F.

**N84-21651#** Joint Publications Research Service, Arlington, Va.
**NEW METHOD AND EQUIPMENT FOR HIGH-FREQUENCY WELDING OF PIPE** **c37**
V. Paton *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 34-36 Transl. into ENGLISH from Sots. Industriya (Moscow), 2 Oct. 1983 p 2 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

An original method of welding on voice frequency with induction power supply is discussed. The method makes it possible to achieve the productivity and stability of a process and production quality, which greatly exceed the corresponding indicators of foreign mills utilizing contact drive of radio frequency current. The standardized model of welding with composite contactless current supply made it possible to produce pipes with a wide range of wall thicknesses at speeds up to 80 m/min. The pipe-welding aggregate embodying it is the only one of its kind: it was designed with a set of equipment for all types of thermal processing. This includes equipment for local thermal processing of welds, which assures a pipeline's reliable operation at low temperatures. Use of the new method of molding pipe skelp has substantially reduced the metal consumption of aggregates and made it possible to shorten the mill's length to two-fifths. Mass production of thin-walled, heat-resistant pipes of low metal consumption and with the diameter to wall-thickness ratio reaching 100 was implemented for the first time on this mill by means of high-frequency welding. Such pipes may be used as gas and drive pipes. R.J.F.

**N84-21652#** Joint Publications Research Service, Arlington, Va.
**WELDING WITH ALLOYING AND ULTRASONIC TREATMENT WITH AN ION BEAM Abstract Only** **c37**
B. Ye. Paton, M. D. Gabovich, S. M. Gurevich, V. N. Zamkov, V. Ya. Poritskiy, and A. D. Shevelev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 37 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 273, no. 1, Nov. 1983 p 104-106 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

A study of the physical and technologic features of an ion beam which can be used to alloy a welding seam and control its properties is discussed. A plasma is diffused from a gas discharge plasma in a vacuum and is transported by a strong magnetic field as a column about 1 mm in diameter. The metal being processed is held at a negative potential of up to 500 V with respect to the plasma. The current density on the axis is up to 100 A/cm squared, specific ion flux power 5 x 10,000 W/square centimeters. The novelty of the method is the increased specific ion flux power and the fact that the flux consists of a controllable mixture of ions of the working gas plus a metal such as titanium. It is found that the ion flux not only introduces atoms of the desired elements into the welded area of the metal, but also subjects the metal to

intensive ultrasonic processing. The concentration of microscopic pores after ion beam welding is lower than after ordinary electron beam welding. Ultrasound also causes a decrease in grain size. R.J.F.

**N84-21653#** Joint Publications Research Service, Arlington, Va.
**OVERALL MECHANIZATION OF ASSEMBLY AND WELDING PROCESSES IN THE MANUFACTURE OF SHIPS' STRUCTURES Abstract Only** **c37**
Yu. I. Simonov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 37-38 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 10, Oct. 1983 p 29-31 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Welding and assembly operations are closely related, with the maximum speed of welding limited by the speed of assembly. Automatic unilateral welding on machines with flux plus copper inserts with bilateral formation of seams is most effective for assembly of panels. This technology reduces welding time by a factor of 1.5-2 and eliminates tilting operations. The method can be used for assembly of panels of steel 3 to 32 mm thick. Metal up to 12 mm thick can be welded without edge preparation. For greater thickness, V-shaped edge preparation is used. An example of a modern installation is disussed. A section with hydraulic pressing of the edges of sheets together during welding, including an accumulator, sheet placer, feed and orienting roller conveyors, assembly and welding stand with suspended welding head, and discharge roller conveyor is illustrated. Photographs of automatic welding equipment used in such installations are presented and technical characteristics are given for the 'brig' automatic machine for unilateral welding of sheets up to 20 mm thick. The welding method is distinguished by the simplicity of technology and equipment and relatively low cost. R.J.F.

**N84-21654#** Joint Publications Research Service, Arlington, Va.
**MECHANIZATION OF ASSEMBLY AND WELDING OPERATIONS IN MANUFACTURE OF SHIP HULL STRUCTURES Abstract Only** **c37**
V. D. Veselkov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 38 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 10, Oct. 1983 p 27-29 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Assembly and welding in shipbuilding refers to a separate stage of ship construction called preliminary assembly, which includes the manufacture of units and sections and amounts to as much as 60% of the entire labor consumed in assembly and welding of the ship's hulls. A plan for overall mechanization of the assembly and welding shop of the plant was developed for the manufacture of units and sections of a universal bulk cargo ship with a displacement of 13,000 tons. Equipment was planned, manufactured and put in operation for the mechanized assembly lines of large webs, flat sections, partitions and bulkheads, bottom and side sections and hatch covers, as well as mechanized sections manufacturing T-beams, bottoms and foundations. A pulsating-flow line manufactures bulkheads and superstructure walls of carbon and low-alloy steels. Pieces up to 9000 mm long and 3500 mm wide can be manufactured of 3--12-mm-thick sheet metal. The use of magnetic transverse prevent deformation of sheets and assemblies during transportation. A continuous-flow line with 5 workplaces is used to manufacture large panels. R.J.F.

**N84-21655#** Joint Publications Research Service, Arlington, Va.
**INTRODUCTION OF PRODUCTIVE WELDING AND SURFACING TECHNOLOGICAL PROCESSES TO PRODUCTION OF NUCLEAR POWERPLANT EQUIPMENT Abstract Only** **c37**
Yu. F. Uglov, I. F. Trofimov, A. A. Khodosevich, M. P. Yun, G. M. Bayrakovskiy, and A. S. Yevtushenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 39 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 10, Oct. 1983 p 20-22 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Welding and surfacing account for over 30% of the total labor consumed in the manufacture of nuclear powerplant equipment. Significant successes were achieved in the area of mechanization of welding and surfacing. Several examples are given of successes which were achieved in automating and mechanizing processes such as surfacing of the internal surfaces of fittings on reactor bodies, automatic welding of joints of complex shape and automatic attachment of fittings to reactors, steam generators and steam separators. Photographs show welding of fittings to a PGV-1000 steam generator by means of an automatic device, automatic electron-arc welding of fittings on a type steam separator, and a machine for automatic welding of circular seams in a VVER-1000 reactor body. The new technological processes for welding, surfacing and electric lag melting were tested and put into extensive use in the production of nuclear power equipment. The level of mechanization of welding has increased from 66.5% in 1975 to 72.5% in 1982, of surfacing from 72.0 to 81.0% and of gas cutting from 72.0 to 79.0%. R.J.F.

**N84-21656#** Joint Publications Research Service, Arlington, Va.
**CERTAIN FEATURES OF A VACUUM MAGNETIC-IMPULSE WELDING PROCESS Abstract Only** **c37**
Ye. L. Strizhakov, M. Kh. Shorshorov, A. I. Asotov, and A. M. Loktionov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 39-40 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow), no. 5, Sep. - Oct. 1983 p 104-108 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

High-energy welding in the solid phase provides effective bonds while preserving original structure. For thin-walled facings, vacuum magnetic-impulse welding has the advantage of eliminating initial clearance or permitting normal contact during welding. Computer calculations for such processes, reducing the need for lengthy practical experiments, are given. The key to accuracy is based on choosing the right mathematical model to take account of the pulsed nature of the electromagnetic field, its penetration into all conductors in the system, motion of the cast element and effect of the discharge contour of the magnetic-impulse apparatus, etc. Features of the process are increased contact rate along with increased clearance, and higher magnetic field power in the clearance between coatings and base at contact time. The discontinuity of the axial components of magnetic field tension is ordinarily about 1% increasing to 15% in small zones near the coating edge. Bonding occurred from the beginning of physical contact until the magnetic pressure began to create a stretching in the bonding zone. R.J.F.

**N84-21657#** Joint Publications Research Service, Arlington, Va.
**SUPERFINE WIRE MADE FROM NEW ALLOY** **c26**
I. Konstantinova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 441-42 Transl. into ENGLISH from Sots. Industriya (Moscow), 15 Dec. 1983 p 4 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

A new alloy of chromium, vanadium and gallium called chrovangal is discussed. A 1,000 meter length of this ultrafine wire weighs only 1 gram. The electrical resistance in this wire changes no more than 0.001 percent over a temperature range of -60 to 200 degrees C. R.J.F.

**N84-21658#** Joint Publications Research Service, Arlington, Va.
**LASER SCREENS OF ZnSe PRODUCED BY BRIDGEMAN METHOD Abstract Only** **c36**
M. P. Kulakov, G. A. Meyerovich, V. N. Ulasyuk, A. V. Fadeyev, and I. Sh. Khasanov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 43 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Neorganicheskiye Materialy (Moscow), v. 19, no. 11, Nov. 1983 p 1807-1810 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Zinc selenide, a rectizonal semiconductor of the AIIBVI group with a 2.7 electron volt forbidden zone width at 300 K, is studied as a material for laser screens. Cathode luminescene of the initial samples was studied to establish the connection between the

resulting spectra and laser screen generation parameters. Results indicated that impurities were eliminated by the crystallization process, which yielded a crystal that diverged from stoichiometry in the direction of excess selenium. Spectral data gathered during production and during laser generation confirm that ZnSe produced by this method can be used to make laser screens with threshold current density of up to 40 A/square centimeters and efficiency of up to 3% at ca. 100 A/square centimeters. Cathode luminescence was an effective criterion for material quality control. Reduced threshold current could be obtained by reducing the concentration of zinc vacancies in the compound's stoichiometry. R.J.F.

**N84-21659#** Joint Publications Research Service, Arlington, Va.
**STRUCTURAL FEATURES OF POLYCRYSTALLINE ZnSe AND SOLID SOLUTIONS ZnSe SUB I-X S SUB X Abstract Only** **c46**

L. F. Komolova, L. A. Grosheva, L. L. Mukhina, V. V. Sakharov, V. V. Proyanenkov, I. V. Razumovskaya, and N. F. Shevtsova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 43-44 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Neorganicheskiye Materialy (Moscow), v. 19, no. 11, Nov. 1983 p 1802-1806 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Polycrystalline zinc selenide, used in optical electronics, and the solid solution ZnSe sub I-x S sub x with its greater thermal resistance are compared during crystal formation and the effects of structural features on optical and mechanical characteristics are summarized. Cathode luminescence, X-ray phase analysis and spectrophotometry showed forms and spectral features at various temperatures of recrystallization. Results indicated that the accumulation of defects at granular boundaries caused poor light transmission and high microhardness values. Granular size was not a factor in microhardness, and was similar for the solid solution as for the polycrystal ZnSe. R.J.F.

**N84-21660#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF ANISOTROPY AND VISCOSITY ON PROPAGATION ON WAVES IN MULTILAYER CYLINDERS Abstract Only** **c32**

Sh. U. Galiyev, V. A. Romaschenko, and Z. G. Alpaidze *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 44 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 40-44 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

A study is presented of the influence of viscosity and anisotropy of the material of several layers of a cylinder of finite length on the propagation of waves caused by the application of an axisymmetrical pressure pulse. The equations of motion of the solid deformed body are integrated by the method of finite differences. An analysis is presented of the influence of the direction of the fibers of an orthotropic layer on the distribution of stresses, as well as the viscosity properties of the layers on wave attenuation. It is shown that the use of outer layers of viscous materials can significantly decrease the stress level in inner layers. This effect increases with a decrease in the duration of loading. For short load pulses which cannot influence the dynamics of the entire structure, the direction of fibers along the line of action of the load increases strength. R.J.F.

**N84-21661#** Joint Publications Research Service, Arlington, Va.
**ANALYSIS OF UNSTEADY PROCESSES CAUSED BY NONAXISYMMETRICAL LOADING OF FINITE MULTILAYER CYLINDERS** **c39**

Z. G. Alpaidze, Yu. N. Babich, and Sh. U. Galiyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 44-45 refs Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 3-7 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

A brief description is presented of an algorithm for calculation of the three-dimensional stress state of multilayer finite cylinders subjected to nonaxisymmetrical loading. The layers in the cylinders are made of different materials. Rigid bonding without interference is achieved between the layers. A pressure pulse ranging from 0.00001 to 10 to the minus 9th power s in length acts on the outer surface. The pressure pulse is distributed around the circumferential direction according to a cosine rule. It is found that the number and placement of layers of dissimilar materials have a significant influence on dynamic strength. In multilayer structures subjected to pulse loading, the outer layer should not be made of a material with significantly inferior mechanical characteristics in comparison to the next inward layer, since this causes a sharp increase in stresses in the structure. The method developed for calculation of the stress-strain state in such structures can be used in planning and dynamic design of variable rigidity structures. In particular, it can be used as the basis for solution of the problem of selecting the placement of layers providing the least stress in multilayer structures. R.J.F.

**N84-21662#** Joint Publications Research Service, Arlington, Va.
**SPECIFICS OF PROCESSES OF DEFORMATION AND MICROFRACTURE OF AMORPHOUS IRON-BASED ALLOYS Abstract Only** **c26**

O. L. Utevskaya, A. M. Glezer, M. M. Kantor, V. N. Kolotinskiy, and B. V. Molotilov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 45 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 272, no. 5, Oct. 1983 p 1114-1118 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

Amorphous Fe-B alloys with the addition of small quantities of elements decreasing surface energy (Sb, Ce) were produced in the form of strips, hardened from a melt on a rapidly rotating disk. The strips were 20 to 50 microns thick, 1.5 to 20 mm wide. The specimens were loaded in a high voltage JEM-1000 electron microscopy column with a standard installation for tensile testing at room temperature, allowing a smooth increase in load or holding at constant load. The stages of crack development are described. Birth and development of the cracks in the alloys are illustrated on electron micrographs. It was established in particular that alloying with small quantities of surface active elements qualitatively changes the mechanism of crack formation and development. R.J.F.

# 24 COMPOSITE MATERIALS

Includes laminates.

**N84-21663** Texas A&M Univ., College Station.
**ON THE EFFECTS OF POST CURE COOL DOWN AND ENVIRONMENTAL CONDITIONING ON RESIDUAL STRESSES IN COMPOSITE LAMINATES Ph.D. Thesis**
Brian Douglas Harper 1983 278 p
Avail: Univ. Microfilms Order No. DA8329924

Four investigations concerning the effects of post cure cool down path and environmental conditioning upon the residual thermal stresses that develop in composite laminates are discussed. The main theme involves an analysis which considers the effects of temperature and moisture upon the time-dependent behavior of the material and all calculations employ recent data on the hygrothermoviscoelastic response of the AS/3502 graphite/epoxy system. The analysis was accompanied by an experimental investigation, where curvatures of anti-symmetric, cross-ply AS/3502 graphite/epoxy laminates were measured as a function of time and compared against theoretical viscoelastic predictions. Additional topics involved a thermoviscoelastic characterization of the Hercules 3502 epoxy resin system, and an assessment of the effects of chemical cure shrinkage strains upon residual stresses. These two subjects involved experimental work, supplemented by appropriate mathematical models. The fourth subject concerns optimal cool down paths which minimize the residual thermal stresses occurring in balanced, symmetric cross-ply laminates.

Solutions were obtained analytically, based upon variational principles. Dissert. Abstr.

**N84-21664** Royal Aircraft Establishment, Farnborough (England). Structures Dept.
**ON THE OPTICAL ASSESSMENT OF THE VOID CONTENT IN COMPOSITE MATERIALS**
D. Purslow Aug. 1983 15 p
(RAE-TM-MAT/STR-1024; BR89751) Copyright. Avail: Issuing Activity

Two simple techniques for assessing void content in a composite using a standard low power optical microscope are presented. Void distributions are compared with a chart showing 0.2%, 0.5%, 1.0%, 2.0% and 5% void content. The second method samples the area in a regular pattern and notes the presence or absence of a void. A classification going from excellent (void content <0.2%) to very poor (void content > 5.0%) is proposed. Specimen preparation and polishing is described. Author (ESA)

**N84-21665#** Defence Research Establishment Pacific, Victoria (British Columbia).
**MOISTURE AND TEMPERATURE EFFECTS ON THE MIXED-MODE DELAMINATION FRACTURE OF UNIDIRECTIONAL GRAPHITE/EPOXY**
A. J. Russell and K. N. Street Dec. 1983 50 p refs Presented at the ASTM Symp. on Delamination and Debonding in Mater., Pittsburgh, 8-10 Nov. 1983
(DREP-TM-83-22) Avail: NTIS HC A03/MF A01

The critical strain energy release rates for interlaminar fracture of unidirectional graphite/epoxy, both from a sharp notch and as a function of crack extension, were determined experimentally for combined tensile/shear loadings. Based on well founded compliance techniques a substantial data base was generated over the temperature range -50 C to 100 C for both dry and moisture saturated states. The fracture energy of the unreinforced epoxy matrix material was also measured. Initiation energies for delamination were found to incease as the proportion of shear loading increased and as the temperature was lowered but were insensitive to moisture content. The Fracture resistance to crack extension was found to increase under tensile dominated loadings with both temperature and moisture content but remained constant for high shear loadings. The applicability of various mixed-mode fracture criteria to both the present data and to available literature data is examined. Author

**N84-21666*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ANALYSIS OF STRESS-STRAIN, FRACTURE AND DUCTILITY BEHAVIOR OF ALUMINUM MATRIX COMPOSITES CONTAINING DISCONTINUOUS SILICON CARBIDE REINFORCEMENT**
David L. McDaniels 2 Mar. 1984 25 p refs Prepared for presentation at 113th Ann. Meeting of the Am. Inst. of Mining, Met. and Petrol. Engr., Los Angeles, 26 Feb. - 2 Mar. 1984
(NASA-TM-83610; E-2032; NAS 1.15:83610) Avail: NTIS HC A02/MF A01 CSCL 11D

Mechanical properties and stress-strain behavior for several types of commercially fabricated aluminum matrix composites, containing up to 40 vol % discontinuous SiC whisker, nodule, or particulate reinforcement were evaluated. It was found that the elastic modulus of the composites was isotropic, to be independent of type of reinforcement, and to be controlled solely by the volume percentage of SiC reinforcement present. The yield/tensile strengths and ductility were controlled primarily by the matrix alloy and temper condition. Ductility decreased with increasing reinforcement content, however, the fracture strains observed were higher than those reported in the literature for this type of composite. This increase in fracture strain is attributed to cleaner matrix powder and increased mechanical working during fabrication. Conventional aluminum and titanium structural alloys were compared and have shown that the properties of these low cost, lightweight composites have good potential for application to aerospace structures. E.A.K.

**N84-21667*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**EDGE CRACK GROWTH OF THERMALLY AGED GRAPHITE/POLYIMIDE COMPOSITES**
James B. Nelson Mar. 1984 22 p refs
(NASA-TM-85763; NAS 1.15:85763) Avail: NTIS HC A02/MF A01 CSCL 11D

Laminates of Celion 6000/LARC-160 and Celion 6000/PMR-15 graphite/polyimide composite materials were aged in air at temperatures of 202, 232, 260 and 288 C for various times up to 15,000 hours. Three unidirectional specimen types were studied: short beam shear (SBS), flexure, and 153 mm square panels. The interior region of the square panels exhibited little or no property degradation, whereas both laminate materials degraded and cracked preferentially at the specimen edge perpendicular to the fibers. Using a dye penetrant, the specimens were X-rayed and the crack depth measured as a function of time and temperature. A time temperature superposition of the crack data was successfully performed using an Arrhenius form for the shift factor. A direct correlation was found for edge crack depth and SBS strength for the LARC-160 laminates but the correlation for PMR-15 laminates was more complex. M.A.C.

**N84-21668*#** Aerotherm Acurex Corp., Mountain View, Calif.
**DEVELOPMENT OF AN IMPACT- AND SOLVENT-RESISTANT THERMOPLASTIC COMPOSITE MATRIX**
C. B. Delano and C. J. Kiskiras Hampton, Va. NASA. Langley Research Center 1 Apr. 1984 76 p refs
(Contract NAS1-16808)
(NASA-CR-172285; NAS 1.26:172285) Avail: NTIS HC A05/MF A01 CSCL 11D

Synthesis, moldability and chloroform, acetone and tricresyl phosphate resistance of 16 polymer compositions are described. These aliphatic heterocyclic polymers include polyimides, polybenzimidazoles, and N-arylenepolybenzimidazoles. A solution condensation (cresol) method to prepare imidized aliphaic polyimides is described. Two polyimides and one polybenzimidazole demonstrate no crazing or cracking during 500 hr exposure to the cited solvents under stress. Modification of one aliphatic polyimide with several aromatic amines suggests that m-phenylenediamine is singular in its behavior to improve the chloroform resistance of that class of polyimides. Author

**N84-21669#** Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
**AN INVESTIGATION OF SOME BASIC PROPERTIES OF HYBRID COMPOSITE MATERIALS Final Report, 1 Aug. 1980 - 31 Oct. 1983**
Tsu-Wei Chou Dec. 1983 38 p
(Contract DAAG29-80-K-0057)
(AD-A138040; ARO-16666.21-EG) Avail: NTIS HC A03/MF A01 CSCL 11/4

During the three years of this contract period, significant research results in hybrid composite materials have been accomplished in the areas of material fabrication, test method development, theoretical analyses of the stiffness and strength properties, as well as modelling the behavior of fabric composites. Altogether, seventeen technical papers have been published as a result of the research work. Some fundamental understandings of the mechanical behavior of hybrid composites have been achieved. Author (GRA)

**N84-21670#** Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
**A SURVEY OF MACROSCOPIC FAILURE CRITERIA FOR COMPOSITE MATERIALS Journal Publication**
S. W. Tsai Nov. 1983 32 p Submitted for publication
(AF Proj. 230-7)
(AD-A138091; AFWAL-TR-84-4025) Avail: NTIS HC A03/MF A01 CSCL 11/4

Popular failure criteria of fiber-reinforced composite materials are described and compared. These criteria are empirical and should only be judged from the standpoint of the fitness to data

and the ease of application. The criteria for orthotropic plies of unidirectional composites are extensions of those for isotropic materials. The quadratic criteria are considered to be the most suitable for both isotropic and composite materials. Macroscopic criteria are essential for design and for providing guidelines for materials improvements. Strictly speaking, failure criteria for multidirectional laminants are valid up to the first-ply failure envelope; i.e., before transverse cracking and delamination occur. Finally, conditions for fully optimized ply properties are easily derived from the quadratic failure criterion. Author (GRA)

**N84-21671#** Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
**CREEP OF CARBON YARNS AND COMPOSITES AT HIGH TEMPERATURE**
L. A. Feldman 1 Dec. 1983 16 p Sponsored in cooperation with ONR
(Contract F04701-83-C-0084)
(AD-A138143; TR-0084(4728-02)-1; SD-TR-83-78) Avail: NTIS HC A02/MF A01 CSCL 11/5

Creep of mesophase- and rayon-based carbon yarns was measured in 2 to 4 ksi tension from 2100 C to failure (2500-2700 C). Resulting creep rates increased with temperature, and activation energies were lower for mesophase- than for rayon-based yarn. Rates of creep measured in pitch-matrix-impregnated yarn bundles were lower than those for unimpregnated bundles. Author (GRA)

**N84-21672#** Wyoming Univ., Laramie. Dept. of Mechanical Engineering.
**AXIAL TEST METHODS DEVELOPMENT FOR 3-D CYLINDRICAL-WEAVE CARBON-CARBON COMPOSITE MATERIALS Interim Technical Report, Sep. 1981 - Aug. 1983**
E. M. Odom and D. F. Adams Nov. 1983 55 p
(Contract N00014-77-C-0503)
(AD-A138221; UWME-DR-301-104-1) Avail: NTIS HC A04/MF A01 CSCL 11/4

Emphasis is on the development of axial test methods suitable for the determination of the mechanical properties of three dimensionally reinforced, cylindrical weave, carbon-carbon composites. Particularly, the axial properties of the single bundle fiber were studied to obtain both ultimate strength and stiffness values. Additionally the compression and tensile properties were measured for these materials. The test methods for measuring these properties appear very promising. Author (GRA)

**N84-21673#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**THE PEEL STRENGTH OF ARAMID ALUMINUM LAMINATE (ARALL)**
M. L. C. E. Verbruggen Jul. 1983 29 p refs Sponsored by ENKA Co.
(VTH-LR-397) Avail: NTIS HC A03/MF A01

The fracture mechanism of peeling of ARALL (a hybrid material obtained by adhesive bonding of thin aluminum sheets and unidirectional aramid prepreg layers) was examined. Peel strength can be widely influenced by varying the volume fraction of the fibers and the adhesive thickness. In an extreme case the peel strength is comparable with the peel strength of pure resin systems. Peel strength can be increased by the improving the wetting properties of the aramid fiber and/or by increasing adhesion at the interface. Adding extra resin films on places where extreme peel forces appear improves peel properties. Author (ESA)

**N84-21674#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**ARAMID ALUMINUM LAMINATE (ARALL): A MATERIAL FOR THE NEXT GENERATION OF AIRCRAFT, A STATE OF THE ART**
L. B. Vogelesang and J. W. Gunnink Aug. 1983 61 p refs Sponsored by Netherlands Foundation for Technical Research (STW) and Netherlands Organization for the Advancement of Pure Research (ZWO)
(VTH-LR-400) Avail: NTIS HC A04/MF A01

A composite consisting of thin adhesive bonded high strength aluminum alloy sheets, strong unidirectional aramid fibers, impregnated with metal adhesive, with prestrain of the material after curing, which results in a compressive residual stress in the metal sheets, is described. It has very favorable fatigue crack growth properties and high tensile yield strength. Unnotched static strength is better than that of aluminum alloy. Weight savings of 30% in fatigue critical areas are possible. Despite the structural fibers in the laminate, nearly all the advantages of metals over pure composites are preserved. Author (ESA)

**N84-21675#** Fulmer Research Inst. Ltd., Stoke Poges (England).
**REVIEW REPORT OF THE THIRD YEAR'S ACTIVITIES ON THE STUDY SURVEY OF ADVANCED MATERIALS**
D. P. Bashford Paris ESA 14 Sep. 1983 12 p
(Contract ESA-4389/80/NL-AK(SC))
(R878; ESA-CR(P)-1838) Avail: NTIS HC A02/MF A01

Mechanical test methods applicable to carbon fiber reinforced plastics (CFRP) were investigated. Moisture absorption and residual stresses in CFRP were studied. Epoxy resins suitable for space structure applications as matrices for fiber reinforced composites were examined. Author (ESA)

**N84-21636#** Joint Publications Research Service, Arlington, Va.
**FEATURES OF PHYSIOCHEMICAL REACTION IN ALUMINUM-BORON COMPOSITE MATERIAL Abstract Only**
V. S. Postnikov, V. I. Lavrentyev, and M. Kh. Shorshorov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 3 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow), no. 5, Sep. - Oct. 1983 p 96-99 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21637#** Joint Publications Research Service, Arlington, Va.
**REINFORCING MATERIALS BASED ON MAGNESIUM OXIDE Abstract Only**
D. Karpinos, V. M. Grosheva, V. N. Morozova, V. P. Dzeganovskiy, Yu. I. Morozov, and K. I. Yakovlev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 3-4 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow), no. 5, Sep. - Oct. 1983 p 93-95 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

# 25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

**N84-21676** Prins Maurits Lab. TNO, Rijswijk (Netherlands).
**SIMULATION OF THE IGNITION OF A MIXTURE OF HYDROGEN AND OXYGEN [SIMULATIE VAN DE ONTSTEKING VAN EEN MENGSEL VAN WATERSTOF EN ZUURSTOF]**
J. R. deWeille Jun. 1983 33 p In DUTCH; ENGLISH summary
(Contract A76/KL/039)
(PML-1983-34; TDCK-78612) Avail: NTIS HC A03/MF A01

A numerical model simulating the combustion of a H2-O2 mixture in N2 in a closed cylinder is discussed. The model consists of three program modules which describe the burning gas reaction kinetics, the diffusion of reaction products in the mixture, and gas flow within the container. The gas kinetics part of the program differs from data obtained from experiments on ignition time. Unless considerable numerical diffusion is allowed, ever increasing discontinuities develop with simulation time in the flow pattern. These discontinuities impede a realistic evolution of the gas flow. Author (ESA)

**N84-21677*#** Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.
**SHOCK TUBE STUDY OF THE FUEL STRUCTURE EFFECTS ON THE CHEMICAL KINETIC MECHANISMS RESPONSIBLE FOR SOOT FORMATION**
Michael Frenklach Nov. 1983 100 p refs
(Contract NAS3-23542)
(NASA-CR-174661; NAS 1.26:174661) Avail: NTIS HC A05/MF A01 CSCL 21B

Soot formation in toluene-, benzene-, and acetylene-oxygen-argon mixtures was investigated to study soot formation in a combustion environment. High concentrations of oxygen completely suppress soot formation. The addition of oxygen at relatively low concentrations uniformly suppresses soot formation at high pressures, while at relatively lower pressures it suppresses soot formation at higher temperatures while promoting soot production at lower temperatures. The observed behavior indicates that oxidation reactions compete with ring fragmentation. The main conclusion to be drawn from the results is that the soot formation mechanism is probably the same for the pyrolysis and oxidation of hydrocarbons. That is, the addition of oxygen does not alter the soot route but rather promotes or inhibits this route by means of competitive reactions. An approach to empirical modeling of soot formation during pyrolysis of aromatic hydrocarbons is also presented. Author

**N84-21678#** Virginia Univ., Charlottesville. Dept. of Chemistry.
**CHEMICAL IONIZATION MASS SPECTROMETRY: NEW METHODOLOGY Final Report, 15 Mar. 1980 - 14 Sep. 1983**
D. F. Hunt 8 Jan. 1984 8 p
(Contract DAAG29-80-C-0101)
(AD-A138037; ARO-17042.8-CH) Avail: NTIS HC AC2/MF A01 CSCL 07/4

The goal of this research program was to develop new methodology for the detection and characterization of organic molecules by mass spectrometry. Specific areas addressed included; gas phase ion molecule isotope exchange reactions for counting hydrogen atoms in specific organic structural environments, optimization of tandem mass spectrometry for the direct analysis of complex mixtures of organics, sequence analysis of peptides in mixtures by the combination of collision activated dissociation and tandem mass spectrometry, fragmentation mechanisms of negative ions, and construction of a tandem quadrupole mass spectrometer with improved sensitivity for operation in the FAB ionization mode in the mass range, 1,000 - 2,000 amu. Author (GRA)

**N84-21679#** California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
**FUNDAMENTAL PROCESSES OCCURRING AT ELECTRODES Final Report, 1 May 1980 - 31 Oct. 1983**
F. C. Anson 9 Jan. 1984 11 p
(Contract DAAG29-80-K-0014)
(AD-A138038; ARO-17154.14-CH) Avail: NTIS HC A02/MF A01 CSCL 07/4

The ARO-supported research in electrochemistry carried out in our laboratory during the last three year period has focused on the behavior of electrodes coated with polyelectrolytes. Various redox couples were incorporated by ion-exchange into the coatings where their electrochemical responses were observed and analyzed. The objectives have been to measure charge propagation rates and cross reaction rate constants for the incorporated reactants which were also tested as electrocatalysts. Most of the results have been summarized in the publications that have resulted from the research. Abstracts from several of these are presented in the body of the report. Author (GRA)

**N84-21680#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**THE DEVELOPMENT OF COMPUTER ROUTINES TO PERFORM A COMPREHENSIVE ANALYSIS OF SPECTROSCOPIC DATA FROM DIATOMIC MOLECULES M.S. Thesis**
J. J. Pow Nov. 1983 50 p
(AD-A138063; AFIT/GEP/PH/83D-9) Avail: NTIS HC A03/MF A01 CSCL 09/2

This thesis is concerned with the development of the computer routines needed to accomplish a thorough analysis of spectroscopic data from diatomic molecules. Two existing programs have been modified. The first takes as input the energy and assigned vibrational levels of each observed line and generates the molecular constants. The second uses the molecular constants to generate a potential energy curve for the molecule using the Rydberg-Klein-Rees method. This curve is then adjusted by the inverted perturbation approach so that the eigenvalues are consistent with the solution of the Schrodinger wave equation. Two new programs have been written. One makes use of CALCOMP plotting equipment to produce graphs which can contain tracings of several of the potential energy curves, depending upon the needs of the user. Another new program uses the eigenfunctions of the various electronic states of a molecule to calculate the transitional probabilities, or Franck-Condon factors. GRA

**N84-21681#** Pennsylvania Univ., Philadelphia. Dept. of Physics.
**MANY ELECTRON EFFECTS IN THE PHOTOELECTRON SPECTRA OF CONDENSED NITRIC OXIDE Interim Report**
C. M. Kao, T. C. Caves (North Carolina State Univ., Raleigh), and R. P. Messmer (GE, Schenectady, N.Y.) 17 Jan. 1984 20 p
(Contract N00014-79-C-0991; SR01391279)
(AD-A138130; TR-18) Avail: NTIS HC A02/MF A01 CSCL 07/4

The valence and core level photoelectron spectra of NO condensed on various substrates as obtained by Tonner et al. can be successfully explained using an NO dimer model in which the two NO molecules form a weak N-N bond via the 2 Pi orbitals of the monomers, resulting in a nearly square geometry. In both the O(1s) and N(1s) regions of the X-ray spectrum there are two intense peaks separated by 3.4 eV. From generalized-valence-bond calculations we find for the N(1s) case, that the peak with the smaller electron binding energy arises from an intermolecular charge transfer from one NO monomer to the other, while the second peak arises from intramolecular screening. The first two peaks in the valence region, which have the smallest binding energies and are separated by 2.6 eV, arise from final states which have Superscript 2A Superscript 1 and Superscript 2B Superscript 2 symmetries, respectively. The 2 Pi orbitals of the monomers combine in-phase and out-of-phase to form a Subscript 1 and B Subscript 2 orbitals of the dimer. The resulting two final states of the dimer depend upon which orbital is occupied by the unpaired electron. GRA

**N84-21682#** BDM Corp., Houston, Tex.
**MICROWAVE-ENHANCED IGNITION IN DIESEL ENGINES Final Report, 13 Jul. - 30 Dec. 1983**
Ronald M. Bass and Alan C. Chachich 15 Dec. 1983 21 p
(Contract DAAE07-83-M-R040)
(AD-A138148; BDM-12780) Avail: NTIS HC A02/MF A01 CSCL 21/2

The ignition technique consists of inserting a horseshoe-shaped wire (igniter) with sharpened ends into a microwave field. When the field is sufficiently intense, an arc forms across the tips, effectively acting as a spark plug. Tests were conducted in a special instrumented waveguide section that could be irradiated with up to 2500 watts of microwave power. The igniter was tested by inserting it into the waveguide test section and increasing the microwave power until an arc was observed. Combustion tests were conducted by inserting the igniter and a small amount of fuel into a quartz tube. The tube was sealed, inserted into the waveguide, and preheated to vaporize the fuel. Microwave power was applied to induce an arc in the igniter. The tube was then removed from the waveguide and cooled, and the condensates were examined to verify that combustion occurred. GRA

**N84-21683#** Pennsylvania Univ., Philadelphia.
**THEORETICAL STUDIES OF METAL CLUSTERS AND OF CHEMISORPTION ON METALS Interim Technical Report**
R. P. Messmer 17 Jan. 1984 28 p Prepared in cooperation

with GE, Schenectady, N.Y.
(Contract N00014-79-C-0991; SR01391279)
(AD-A138175; TR-19) Avail: NTIS HC A03/MF A01 CSCL 07/2

The results of different theoretical methods are compared in the analysis of three illustrative problems. The methods involved are: local density functional (LDF), X alpha, Hartree-Fock, generalized valence bond (GVB) and configuration interaction (CI). The three problems considered are: (1) the bonding of Mo2 and CR2, (2) the photoelectron spectra of CU clusters, and (3) the chemisorption of N2 on Ni. The comparisons provide new insights both into these problems and into the physical content of the methods per se. In the case of the comparison of studies on Cu clusters, one is led to reinterpret the nature of photoemission from narrow d-bands and its relationship to conventional band theory.
Author (GRA)

**N84-21684#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PULSED GENERATION OF SINGLET DELTA OXYGEN (O2(1 DELTA)) VIA OZONE PHOTOLYSIS M.S. Thesis**
L. P. Schelonka Dec. 1983 76 p
(AD-A138195; AFIT/GEP/PH/83D-12) Avail: NTIS HC A05/MF A01 CSCL 07/5

Ozone was stored on silica gel at -77 C and photolyzed at pressures from 0.1 torr to 20 torr using an excimer laser of wavelength 2480A. The wavelength of the emission which was deducted following photolysis is in agreement with previously reported hot band production of O2(1 delta) v=1. Quenching of the emission occurred in 0.5 to 2 milliseconds, which may have been due to resonant transfer from O2(1 delta) to I(2P1/2). The iodine in the system was residual from prior experiments. At pressures above 3 torr, ozone combustions and detonations occurred. Combustion produced an orange glow at 5860 + or - 50A, and detonation produced an audible shock wave which traveled at 4 + or - 2 meters per second. Author (GRA)

**N84-21685#** General Electric Co., Schenectady, N. Y. Research and Development Center.
**APPLICATIONS OF LASER SCATTERING PROBES TO TURBULENT DIFFUSION FLAMES Final Report, 1 Sep. 1980 - 31 Aug. 1983**
M. Lapp, M. C. Drake, C. M. Penney, and R. W. Pitz Nov. 1983 14 p
(Contract N00014-80-C-0882)
(AD-A138207; SRD-84-012) Avail: NTIS HC A02/MF A01 CSCL 21/2

The objective of this work is to determine flame properties useful for the advancement of combustion system modeling procedures and design aids, particularly in areas related to the interactions between flame turbulence properties and high temperature combustion chemistry. Toward this goal, measurements have been made of flame structure important for understanding and verifying the basic assumptions upon which the models are based. Thus, we have used spontaneous Raman scattering to determine average and excursion values of the flame front and the viscous superlayer for a co-flowing jet turbulent diffusion flame, and planar laser-induced fluorescence to provide two-dimensional instantaneous images of the flame reaction zones themselves over a range of Reynolds numbers. Author (GRA)

**N84-21686#** Illinois Univ., Urbana.
**SURFACE IGNITION AND HETEROGENEOUS CATALYSIS OF HYDROCARBON FUELS Final Report, 15 Jul. 1980 - 15 Oct. 1983**
R. I. Masel and R. O. Buckius 25 Oct. 1983 50 p
(Contract DAAG29-80-C-0111)
(AD-A138214; ARO-16915.5-EG) Avail: NTIS HC A03/MF A01 CSCL 21/2

This work shows theoretically and experimentally that catalytic combustion is a viable concept at time scales characteristics of those in an engine. A transient code has been developed for hydrogen and carbon monoxide code over a flat plate. Results show that ignition can occur in a time as short as .0001 sec at reasonable temperatures. General operating regions for ignition as a function of the fundamental variables are developed. Radiation heat transfer was also found to be important. Experiments were done for hydrogen combustion over a flat plate were completed which verify the trends seen above. In addition several unexpected phenomenon were observed including self sustained oscillations and isothermal multiplicity and modeled. A detailed kinetic model for formaldehyde combustion has been developed. The main conclusion from the above studies is that catalytic combustion is a complicated process, but it's a viable concept under time scales characteristics of those in an engine.
Author (GRA)

**N84-21687#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**SPECTROSCOPY AND KINETICS OF LEAD OXIDE CHEMILUMINESCENCE M.S. Thesis**
C. M. Ritchey 12 Dec. 1983 123 p
(AD-A138250; AFIT/GEP/PH/83D-10) Avail: NTIS HC A06/MF A01 CSCL 07/2

Chemiluminescence from lead oxide has been observed from the reaction between lead (Pb) vapor and O2(1 delta). The spectrum obtained from this emission has been compared to that obtained from the chemiluminescence observed during the reaction between Pb and ground state O2(3 sigma). A significant enhancement of the A and B states over the a state was noted. Spectral analysis has led to the assignment of 225 transitions from the a, b, A, B, C, C', D and E excited states to the ground state. A simple kinetic analysis was performed for the two reactions in which a plot of the logarithm of the intensity of a spectral band vs 1/T K was prepared. From the slope of the straight lines produced, the activation energies of the two reactions were calculated. GRA

**N84-21688#** California Univ., Berkeley. Dept. of Chemistry.
**CROSSED MOLECULAR BEAM STUDIES OF THE REACTIONS OF OXYGEN AND FLUORINE ATOMS Annual Report, 22 Nov. 1982 - 31 Dec. 1983**
Y. T. Lee 15 Feb. 1984 10 p
(Contract N00014-83-K-0069)
(AD-A138299) Avail: NTIS HC A02/MF A01 CSCL 07/5

This report describes the construction of an advanced, high-resolution, photofragmentation-translation spectrometer. The major features of the machine are as follows. It is capable of measuring the differential, cross-section and translational-energy distributions of collisionless, photochemical events. It has a rotating, molecular-beam source and a fixed detector. This allows extreme temperatures in the bakeout process which will give very low background in the detector. The detector is an advanced design, electron-impact ionization, quadrupole mass-spectrometer. The pumping system uses cryopumping and turbomolecular pumps. This will increase the pumping speed for hydrocarbons and allow the low background detection of hydrocarbon masses. The purpose of this machine is to measure the product translational-energy distributions of photochemical processes, especially the photodecomposition of rocket fuel prototypes, so called 'energetic materials'. The low vapor pressure of these substances requires an efficient detector with a low background at hydrocarbon masses. Author (GRA)

**N84-21689#** National Aeronautical Establishment, Ottawa (Ontario).
**DUAL ADSORBER-CAPILLARY COLUMN SYSTEM FOR GAS CHROMATOGRAPHIC ANALYSIS OF AIR SAMPLES**
M. E. Krzymien Nov. 1983 27 p
(AD-A138305; NAE-AN-20; NRC-22889) Avail: NTIS HC A03/MF A01 CSCL 07/4

An interface which allows thermal desorption and subsequent capillary gas chromatographic analysis of air samples is described. A small solid sorbent trap is positioned between the sampling tube and capillary column. A sample thermally released from the sampling tube is transferred by a carrier gas at high flow rate to

the trap and retained. From there it is again thermally released and transferred to the capillary column by carrier gas at a low flow rate, as required by capillary GC. The transfer and injection steps are effected by means of externally placed solenoid valves. The performance of the system depends on the desorption temperature and time allowed for transfer of the sample between the two adsorbers and the column. These parameters are programmable and can be changed to suit the requirements of a particular analysis. The system allows the analysis of sub-parts-per-billion concentration levels in a comparatively simple and reproducible manner. Operation of the system does not require cryogenic cooling of either the trap or the GC oven. Chromatograms of a variety of air samples are presented and discussed.
Author (GRA)

**N84-21690#** IBM Research Lab., San Jose, Calif.
**THEORY OF SURFACE ENHANCED RAMAN SCATTERING: A PROSPECTIVE VIEW Technical Report**
M. R. Philpott Aug. 1983 12 p Presented at Intern. Conf., Ellipsometry and Other Opt. Methods for Surface and Thin Film Analysis, Paris, 7-10 Jun. 1983
(Contract N00014-82-C-0583)
(AD-A138320; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Theoretical understanding of the origins of strong Raman signals from molecules near roughened Ag, Cu, and Au surfaces has progressed to the point where the action of two very different types of process are recognized. There is chemical enhancement that is apparent only for chemisorbed species, as for example, specifically adsorbed anions on Ag electrodes. The chemical mechanism is poorly understood, however, ingenious ideas and concepts have been advanced, including localization of electron hole pair states and optically driven charge transfer between adsorbate and metal, to model aspects of the chemical enhancement. The second and best understood process is the enormous enhancement of the incoming and outgoing radiation fields at the surface resulting from lightening rod geometries and the excitation of localized surface plasmon modes. Calculations show that for special geometries, very high (approximately 1,000,000 - 10,000,000) enhancement factors are possible in confined regions.
Author (GRA)

**N84-21691#** IBM Research Lab., San Jose, Calif.
**SURFACE PLASMON-ENHANCED RAMAN SCATTERING AT THIN SILVER FILMS Technical Report**
R. M. Corn and M. R. Philpott 12 Nov. 1983 22 p
(Contract N00014-82-C-0583)
(AD-A138321; TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

Raman spectra are reported for liquids and Langmuir films enhanced by the electromagnetic fields of plasma surface polaritons at flat silver surfaces. The Kretschmann prism coupling configuration is used to excite the incident surface polariton and to couple out the Raman shifted surface wave. The spectra are interpreted with the help of a simple quantum theory and compared with previously reported grating spectra. Enhancement factors, polarization characteristics, and the feasibility of using surface polaritons to enhance the Raman spectra of adsorbates on flat electrodes in contact with aqueous electrolyte are discussed.
Author (GRA)

**N84-21692#** IBM Research Lab., San Jose, Calif.
**THE POTENTIAL DEPENDENCE OF SURFACE PLASMON-ENHANCED SECOND HARMONIC GENERATION AT THIN FILM SILVER ELECTRODES**
R. M. Corn, M. Romagnoli, M. D. Levenson, and M. R. Philpott Nov. 1983 23 p
(Contract N00014-82-C-0583)
(AD-A138322; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07/4

The intensity of second harmonic light generated from plasmon surface polaritons at thin film silver electrodes in contact with an aqueous electrolyte exhibits a strong dependence on electrode potential for a variety of electrochemical systems. The surface plasmons enhance the electromagnetic field at the surface, thereby greatly increasing the second harmonic intensity at the interface. We have measured the potential dependence of surface plasmon enhanced second harmonic generation at a silver electrode for aqueous solutions of sodium perchlorate, sodium thiocyanate, urea (a strong adsorbate), and for a buffered solution of lead acetate in the underpotential deposition region where a monolayer of lead is deposited onto the silver. The results can be interpreted by a simple theory relating the second harmonic signal to the static electric field at the surface; to the first order this field is proportional to the excess charge density on the metal.
Author (GRA)

**N84-21693#** City Univ. of New York, N. Y. Dept. of Physics.
**IMPEDANCE RELAXATION SPECTRUM ANALYSIS OF OXIDIZED SILVER ELECTRODES**
M. Hepel and M. Tomkiewicz 31 Jan. 1984 42 p
(Contract N00014-81-K-0399)
(AD-A138380; TR-4) Avail: NTIS HC A03/MF A01 CSCL 09/1

The real and imaginary parts of the impedance of the oxidized silver electrode in 1M KOH solutions, have been measured in a frequency range of 1 to 13,000,000 Hz. When the electrode is oxidized at a potential when only Ag2O is formed, we were able to isolate three passive elements: the high frequency capacitance and the high and low frequency resistances. On further oxidation, at a potential in which AgO can be formed, we were able to isolate five passive elements: two capacitance and three resistive. Two of these elements were identified as originating from the Ag2O layer. The functional dependence of all these elements on the amount of charge that is used for oxidation, reveals that the Ag2O layer can be analyzed in terms of a single dielectricum in a parallel plate capacitor. Parameters such as thickness of the layer, resistivity of the material and roughness factor could be evaluated. We have found that at the potential in which AgO is formed, significant fraction of the charge is being used for formation of Ag2O.
Author (GRA)

**N84-21694#** City Univ. of New York, N. Y. Dept. of Physics.
**STUDY OF THE INITIAL STAGES OF ANODIC OXIDATION OF POLYCRYSTALLINE SILVER IN KOH SOLUTIONS**
M. Hepel and M. Tomkiewicz 31 Jan. 1984 45 p
(Contract N00014-81-K-0399)
(AD-A138381; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

Growth of the anodic Ag2O film on a polycrystalline silver disk electrode in 1 mol/cu. dm KOH solution at ambient temperature has been examined using a variety of electrochemical techniques. On the basis of the experimental results, a solid-state model of silver electrode covered by a thin semiconductor film with a finite ionic conductivity has been proposed. It has been found, that under potentiostatic control, thickness of the oxide film adjusts very quickly to the hydrodynamic conditions by a deposition/dissolution process and the steady-state oxidation currents fulfill the Levich equation for RDE despite the fact that the electrode is covered by a thin Ag2O film. In the case of thicker film, after completion of nucleation and growth, changes in the hydrodynamic conditions do not influence the oxidation current and adjustment of the thickness of the oxide film to new hydrodynamic conditions proceeds at slower rate because of the slowness of the solid-state diffusion step. The Ag2O nucleation and growth peak has been observed in chronoampermetric transients above potential of + 240 mV(vs. Ag/AgCl). It has been observed that the nucleation and growth peak decreases as the convective diffusion is accelerated by the rotation speed of the RDE.
GRA

**N84-21695#** City Univ. of New York, N. Y. Dept. of Phys1cs.
**POROUS ELECTRODES 1: NUMERICAL SIMULATION USING RANDOM NETWORK AND SINGLE PORE MODELS**
M. Kramer and M. Tomkiewicz 31 Jan. 1984 45 p
(Contract N00014-81-K-0399)
(AD-A138382; TR-5) Avail: NTIS HC A03/MF A01 CSCL 12/1

A Random Network model is introduced to stimulate the porous metal-electrolyte interface. This is the first time that an attempt has been made at defining a model for this system that maintains the random nature of the rough topology. A previously utilized model for this system - the single pore model is explored

and extended. The models are compared, and the results of the Random Network model are found to be in qualitative agreement with the single pore models. Author (GRA)

**N84-21696#** California Univ., Livermore. Lawrence Livermore Lab.
**REVIEW OF HYDROGEN ISOTOPE PERMEABILITY THROUGH MATERIALS**
S. A. Steward 15 Aug. 1983 22 p refs
(Contract W-7405-eng-48)
(DE84-007362; UCRL-53441) Avail: NTIS HC A02/MF A01

A comprehensive summary of the literature of hydrogen isotope permeability through materials that do not readily form hydrides is presented. The focus was on pure metals with low permeabilities because of their importance to tritium containment, data on higher-permeability materials such as iron, nickel, steels, and glasses was also given. DOE

**N84-21697#** Yale Univ., New Haven, Conn.
**SIMULTANEOUS MULTIPOINT MEASUREMENTS OF DENSITY GRADIENTS AND TEMPERATURE IN A FLAME Progress Report, 1 Jul. 1983 - 31 Jan. 1984**
R. K. Chang, B. T. Chu, and M. B. Long Feb. 1984 11 p ref
(Contract DE-AC02-81ER-10969)
(DE84-006832; DOE/ER-10969/3) Avail: NTIS HC A02/MF A01

An account is given of recent progress in the development of nonintrusive optical diagnostic techniques and the application of these techniques to turbulent combustion systems. The primary focus of the work over the past year has been in: (1) the use of a broadband rotational coherent anti-Stokes Raman scattering (CARS) technique for the measurement of temperature in flames, (2) the use of broadband rotational N2 CARS from many spatially resolved volume elements along a cylindrical line in air, and (3) the development of a technique to significantly increase the effective frame rate of our existing camera from approx. 30 frames/s to more than 2000 frames/s. A summary of new results in each of these areas is given. DOE

**N84-21698#** Los Alamos Scientific Lab., N. Mex.
**EQUATION OF STATE FOR TITANIUM DIHYDRIDE**
B. I. Bennett Jan. 1984 16 p refs
(Contract W-7405-eng-36)
(DE84-006698; LA-9895-MS) Avail: NTIS HC A02/MF A01

The equation of state for silver-bonded TiH2 has been computed for a large range of temperatures and densities. The resulting tabulation, residing in the SESAME data library, agrees well with shock wave data and is an improvement over rational function forms and additive volume mixing schemes. DOE

**N84-21699#** California Univ., Berkeley. Lawrence Berkeley Lab.
**SECOND BERKELEY CATALYSIS AND SURFACE SCIENCE CONFERENCE Abstracts Only**
Jan. 1984 26 p refs Conf. held in Berkeley, Calif., 11-13 Jan. 1984
(Contract DE-AC03-76SF-00098)
(DE84-005536; LBL-16784; CONF-840102-Absts) Avail: NTIS HC A03/MF A01

The 19 abstracts are grouped under the headings: chemicals from methanol, hydrotreating of hydrocarbons, catalyst preparation, monomers and polymers, and photocatalysts and photovoltaics. DOE

**N84-21700#** Thorn EMI, Hayes (England).
**CHEMICAL AND PHYSICAL PROCESSES ON NONEMISSIVE GRIDS**
T. M. Gardiner Paris ESA Jul. 1983 49 p refs
(Contract ESA-5172/82/NL-PP(SC))
(EVT-825; ESA-CR(P)-1820) Avail: NTIS HC A03/MF A01

Chemical and physical processes on the emission suppressant Zr based coating on amplifier tube focus grids were investigated. Laboratory samples specially prepared and treated and grids from failed tubes were examined. Selection criteria are suggested. The best method of increasing the lifetime of the coating is to use as thick a Zr coating as is practical. The coating has no detrimental effects on cathodes. Author (ESA)

**N84-21701#** Karlsruhe Univ. (West Germany). Inst. fuer Physikalische Chemie und Elektrochemie.
**THERMAL PROPERTIES OF BINARY AQUEOUS SOLUTIONS AT HIGH TEMPERATURES AND HIGH PRESSURE Final Report, Nov. 1982**
Ernst Ulrich Franck, Richard Hilbert, Terry Seward, and Klaus Toedheide Bonn Bundesministerium fuer Forschung und Technologie Oct. 1983 82 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-83-217; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 17,50

Aqueous sodium chloride solutions are studied. Pressure-volume-temperature (PVT) data were measured up to 400 C and 4000 bar between 0.1 and 25 weight percent sodium chloride with an accuracy $> 0.2\%$. From the measured data the apparent molar volume of the salt was calculated as a function of concentration. An equation of state was developed for the apparent molar volume which enables the calculation of the chemical potentials, activities, and other thermodynamic functions of each component. The phase diagram of the system H2O-H2 and its PVT data in the homogeneous range were measured up to 440 C and 2500 bar. Gas-gas equilibria occur in this system. Excess volumes are large and positive at low and intermediate pressures. Author (ESA)

**N84-21702#** Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany). Forschungslab.
**ELECTROPHORETIC RECORDING OF COLOR IMAGES WITH HIGH QUALITY Final Report, Dec. 1981**
Herbert Loebl and Rainer Pape Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 74 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Original contains color illustrations
(BMFT-FB-T-83-319; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15,50

A high quality color recording method for electronic archival systems or hardcopy generation of video images is presented. Electronic image signals were converted into visible toner images. Charged toner particles from a colored toner suspension were electrophoretically deposited onto an image drum by electric fields. One-color images composed of yellow, cyan, magenta and black were successively printed in exact register onto the image drum, from which the whole color image was transferred onto paper in a single transfer step. Serial and parallel color recording setups were investigated. By serial setup the picture elements are successively printed while by parallel setup a linewise recording is employed. Both setups generate good continuous-tone color images without point structure. A recording time between 40 and 60 sec for a color image of A4 size is obtained with the parallel recording technique. Author (ESA)

**N84-21703#** Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
**PROCEEDINGS OF THE 5TH WORKSHOP ON CATALYTIC COMBUSTION**
John P. Kesselring Jan. 1984 432 p refs Workshop held in San Antonio, 15-16 Sep. 1981; sponsored by EPA
(Contract EPA-68-02-3122)
(PB84-145580; EPA-600/9-84-002) Avail: NTIS HC A19/MF A01 CSCL 07D

The proceedings document the major presentations at the Fifth Workshop on Catalytic Combustion, in San Antonio, Texas, September 15-16, 1981. Sponsored by the Combustion Research Branch of EPA's Industrial Environmental Research Laboratory-Research Triangle Park, the workshop served as a forum for the presentation of results of recent research in the areas of catalyst performance, use of heavy fuels in catalytic combustion, and applications of catalytic combustion. The workshop provided

industrial, university, and government representatives with the current state-of-the-art in the application of catalytic combustion systems for pollution control and performance improvement. Applications include firetube and watertube, boilers, stationary and mobile gas turbines, and diesel engine exhaust systems. GRA

**N84-21704#** Battelle Northwest Labs., Richland, Wash.
**MINTEQ: A COMPUTER PROGRAM FOR CALCULATING AQUEOUS GEOCHEMICAL EQUILIBRIA Final Report, Sep. 1981 - Aug. 1983**
A. R. Felmy, D. C. Girvin, and E. A. Jenne Feb. 1984 98 p refs (Contract EPA-68-03-3089)
(PB84-157148; EPA-600/3-84-032) Avail: NTIS HC A05/MF A01 CSCL 07D

MINTEQ is a computer program for computation of geochemical equilibria. MINTEQ was developed for incorporation into the Metals Exposure Analysis Modeling System (MEXAMS), a modeling system for the assessment of the fate and migration of selected priority pollutant metals in aquatic systems. MINTEQ combines the best features of two existing geochemical models MINEQL and WATEQ3. The mathematical structure was taken from MINEQL. The WATEQ3 features were added to this basic structure. The main features obtained from WATEQ3 are the well referenced thermodynamic data base, temperature correction of equilibrium constants using either the Van't Hoff relationship or analytical expressions for the equilibrium constants as a function of temperature and ionic strength correction using either the extended Debye-Huckel equation or the Davies equation. Author (GRA)

# 26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

**N84-21705#** United Kingdom Atomic Energy Authority, Risley (England).
**CHEMICAL VAPOUR DEPOSITION COATING OF HARD METALS WITH SPECIAL REFERENCE TO BORON AND BORON COMPOUNDS**
K. Voigt and H. Westphal 13 Jan. 1984 16 p refs Transl. into ENGLISH from Proc. of the 10th Plansee-Seminar, v. 2, 1981 p 611-624
(BLL-Risley-Trans-4877) Avail: British Library Lending Div., Boston Spa, Engl.

The possible ways of depositing hard materials containing boron onto hard metal using chemical vapor deposition technology (CVD) are presented. The deposition of boron containing hard material layers and the strengthening of the substrate in the region of the layer are combined in a suitable process. CVD equipment with a cold wall retort has proved suitable for carrying out the coating process. The results of this research were used in the development of multi-range coated hard metal tips for machining short chip materials. Because of their outstanding physical properties and chemical resistance, high melting point inorganic boron compounds such as boron carbide, cubic boron nitride and heavy metal borides have found increasingly wide application, particularly in the last 30 years, in metallurgy, in industrial furnace construction, as grinding and polishing agents, and in reactor and materials technology. Author

**N84-21706#** United Kingdom Atomic Energy Authority, Risley (England).
**THE DUCTILITY OF METAL DIFFUSION COATINGS ON NICKEL ALLOYS AND THEIR CHARACTERIZATION**
H. Brandis, G. Lehnert, and W. Schmidt 13 Jan. 1984 26 p refs Transl. into ENGLISH from Thyssen Edelstahl Tech. Ber. (West Germany), v. 7, no. 1, 1981 p 82-91
(BLL-Risley-Trans-4883) Avail: British Library Lending Div., Boston Spa, Engl.

The ductility properties of metallic diffusion coatings which are used against hot corrosion on turbine blades were measured using acoustic emission during crack initiation within the coating or substrate in a temperature range up to 850 C using coated stress rupture specimens. The substrates under investigation are two nickel-based superalloys IN 738 LC (Vakumelt ATS 385 LC-G) and IN 100 (Vakumelt ATS 391-G), coated with platinum aluminum diffusion coating LDC-2 and compared to a nickel aluminide coating and a chromium diffusion coating. A coating is defined as ductile when the first crack initiation occurs at stresses exceeding the elastic limit of the the base material. The influence of coating thickness and strain rate was also investigated. Temperature-dependent stress and strain levels established below which the coating behaves in a ductile manner were established. Author

**N84-21707#** British Gas Corp., London (England).
**SOME ASPECTS OF THE CORROSION OF IRON IN ALKALINE SOLUTIONS AND ASSOCIATED FUNDAMENTAL PROBLEMS**
W. Schwenk 24 Jan. 1984 6 p refs Transl. into ENGLISH from Werkst. Korros. (West Germany), v. 34, 1983 p 287-289
(BLL-T6234/BG/LRS/LRST677/83) Avail: British Library Lending Div., Boston Spa, Engl.

There are some indications of iron corrosion in alkaline solutions with unexpectedly high rates. These reactions can be understood thermodynamically only in terms of the formation of complex compounds, e.g., with hydroxide ions. Furthermore, it is demonstrated that the effect of cathodic protection is more established by the formation of protective films than by the shift into the equilibrium state. Considerations about the active passive behavior show that thermodynamical explanations of the activation potential (Flade potential) must fail. Author

**N84-21708#** British Library Lending Div., Boston Spa (England).
**DIFFUSIONAL ANOMALIES IN DEFORMED METALS**
Yu. S. Nechaev, S. A. Vladimirov, and N. A. Olshevskii 31 Jan. 1984 3 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Met., (USSR), no. 5, 1983 p 142-143
(BLL-M-35490-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

Published information on the effect of deformation on diffusion in metals is considered in relation to anomalous diffusion effects. Author

**N84-21709#** British Library Lending Div., Boston Spa (England).
**DETERMINATION OF THE MIXING POTENTIAL IN ALLOYS FROM EXPERIMENTAL DATA ON SHORT-RANGE ORDER**
Yu. S. Stark, A. S. Shteinberg, and V. M. Vasilev 31 Jan. 1984 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Met. (USSR), v. 5, 1983 p 150-151
(BLL-M-35498-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

A procedure based on the Monte Carlo method is proposed for determining the energy of mixing in alloys and thus explaining certain special features of ordering in real systems. Author

**N84-21710#** British Library Lending Div., Boston Spa (England).
**NIOBIZING CARBON STEELS**
V. F. Loskutov and M. N. Bobina 31 Jan. 1984 4 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chernaya Met. (USSR), v. 5, 1983 p 154
(BLL-M-35502-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The influence of the amount of carbon tetrachloride introduced into the reaction space on the composition and properties of niobium-carbide coatings obtained on the surface of a number of carbon steels was investigated. Author

**N84-21711#** British Library Lending Div., Boston Spa (England).
**INFLUENCE OF MICROPLASTIC DEFORMATIONS ON SPHEROIDIZATION OF CEMENTITE IN STEEL**
A. A. Ryzhikov, V. A. Baranova, and N. I. Artsybasheva 31 Jan. 1984 3 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Met. (USSR), v. 5, 1983 p 154-155
(BLL-M-35503-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

It is shown that preliminary microplastic deformations occurring under the action of variable-sign loads or ultrasonic treatment promote spheroidization during subsequent subcritical annealing of U8 steel. Author

**N84-21712#** British Library Lending Div., Boston Spa (England).
**INFLUENCE OF THE BASE METAL ON THE WEAR-RESISTANCE OF HIGH-STRENGTH CAST IRON**
N. V. Chernyshova, G. I. Ezhov, and B. I. Aleksandrov 31 Jan. 1984 3 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Met. (USSR), v. 5, 1983 p 155-156
(BLL-M-35504-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The wear resistance of high strength cast iron alloys obtained by inoculation in the mold with various magnesium master alloys was investigated. Results show that high strength spherical graphite cast iron, whose base metal consists of perlite with a small amount of uniformly distributed free cementite has the best wear resistance under abrasive wear conditions. The resistance of such a cast iron is 1.4 times greater than that of a pearlitic cast iron. The appearance of ferrite in the base metal of the cast iron sharply reduces wear resistance. A.R.H.

**N84-21713#** British Library Lending Div., Boston Spa (England).
**PRODUCTION OF POROUS SHEETS FROM METALLIC POWDERS**
L. S. Shmelev, V. K. Sorokin, and N. V. Gureev 31 Jan. 1984 5 p refs Transl. into ENGLISH from Stal (USSR) p 82-83
(BLL-M-35465-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The rolling of Kh18W15 corrosion resistant steel powder to form porous sheet, the sintering of the sheet, and the density and porosity characteristics of the product are briefly considered. Author

**N84-21714#** British Library Lending Div., Boston Spa (England).
**ANALYTICAL DETERMINATION OF RESISTANCE OF ALUMINIUM ALLOYS TO DEFORMATION**
Ya. M. Okhrimenko, V. N. Shcherba, A. V. Nedugov, D. B. Efremov, and A. Borovikov 31 Jan. 1984 7 p refs Transl. into ENGLISH from Izv. (USSR), v. 5, 1983 p 52-55
(BLL-M-35476-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The results of analytical determination of the resistance of aluminum alloys to deformation indicate that the rheological properties of many such alloys is described in terms of exponential functions. The dependence of parameters C and m characterizing the plastic properties and response to deformation speed on the temperature at which the alloy is worked are in many instances anything but linear and are therefore of independent interest. The closeness of approximation offered by the presented method can be increased by both making the given model more complex or justifiably reducing the ranges of variation of the investigated factors. Author

**N84-21715#** United Kingdom Atomic Energy Authority, Risley (England).
**ION PLATING OF COATINGS MADE FROM HIGH MELTING POINT METALS**
W. Schintlmeister 13 Jan. 1984 18 p refs Transl. into ENGLISH from Proc. of the 10th Plansee-Seminar, v. 2, 1981 p 625-656
(BLL-Risley-Trans-4879) Avail: British Library Lending Div., Boston Spa, Engl.

Following a short review of ion plating the production of W- and W-Re coatings is described. Problems of coating thickness distribution, formation of coating defects and composition of alloys are discussed. The influence of gas pressure and base material on the coating structure and adhesion are indicated. Finally, the tantalum coating of different materials such as titanium, molybdenum and various steels is reported on, and also the behavior of these coatings under stress (quenching, bending). Author

**N84-21716*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**FRICTION AND WEAR OF IRON IN SULFURIC ACID**
George W. P. Rengstorff (Toledo Univ.), Kazuhisa Miyoshi, and Donald H. Buckley Apr. 1983 22 p refs
(Grant NAG3-276)
(NASA-TP-2289; E-1635; NAS 1.60:2289) Avail: NTIS HC A02/MF A01 CSCL 11F

Elemental iron sliding on aluminum oxide in aerated sulfuric acid concentrations ranging from very dilute (0.000007 N; i.e., 4 ppm) to very concentrated (96 percent acid) was studied. Load and reciprocating sliding speeds were kept constant. With the most dilute acid of 0.7 to 0.0002 N, a complex corrosion product formed that was friable and often increased friction and wear. At concentrations of 0.001 N, metal losses were essentially by wear alone. Because no buildup of corrosion products occurred, this acid concentration became the standard from which to separate metal loss from direct corrosion and mechanical wear losses. When the acid concentration was increased to 5 percent, the high corrosion rate of iron in sulfuric acid strongly dominated the total wear loss. This strong corrosion increased to 30 percent acid, and decreased somewhat at 50 percent in accordance with expectations. However, the low corrosion of iron expected at acid concentrations of 65 to 96 percent was not observed in the wear area. It is apparent that the normal passivating film was being worn away and a galvanic cell established which rapidly attached to the wear area. A.R.H.

**N84-21717#** Materials Research Labs., Melbourne (Australia).
**HIGH-TEMPERATURE OXIDATION OF ALPHA NICKEL-SILICON. 1: REACTION KINETICS; THERMOGRAVIMETRY**
Lawrence D. Palmer Feb. 1984 43 p refs
(MRL-R-887; AR-003-300) Avail: NTIS HC A03/MF A01

The reaction kinetics of the high-temperature oxidation of alpha binary nickel-silicon alloys and the thermocouple alloy Nisil was studied. Rates of oxidation at temperatures in the range from 850 to 1250 C were measured by thermogravimetric methods under both isothermal and cyclic temperature conditions for periods of up to 164 h. Silicon in the alloys provides enhanced protection against high-temperature oxidation. Of the alloys studied, Nisil - a nickel-silicon-magnesium alloy - exhibited the greatest resistance to high-temperature oxidation. The agreement of the kinetic data with a simple parabolic rate law was assessed. For the low-silicon alloy Ni-0.9Si, the parabolic rate constant showed little variation throughout 164 h oxidation tests, whereas the rate constants for higher-silicon alloys generally decreased with time. This behavior is discussed in terms of the diffusion of reactants through the growing oxide scales, whose composition and mechanical integrity may vary with time. An activation energy of 175 + or - 21 kJ per mol was derived for the high-temperature oxidation of Ni-0.9Si. Author

**N84-21718#** Materials Research Labs., Melbourne (Australia).
**ESR STEEL DEOXIDATION AND SLAG PRACTICE: INFLUENCE ON INCLUSION MORPHOLOGY**
G. M. Weston and R. C. Andrew Jan. 1984 31 p refs
(MRL-R-915; AR-003-896) Avail: NTIS HC A03/MF A01

The electroslag refining (ESR) operations draws upon detailed technical records of both production and experimental operations over an extended period. A wide range of slag/deoxidant combinations used during the electroslag refining of low alloy steels was evaluated to determine the influence on the types of inclusion and their morphology in the final steel product. No significant variations in inclusion type or overall cleanliness were observed for the more conventional ($CaF_2 + CaO + MgO + Al_2O_3$) slags or for those containing up to 10% silica, whether they were combined with aluminum, calcium silicide or Hypercal deoxidation treatment. Trends were towards slightly increased amounts of globular type D inclusions and reduced aluminate levels when using calcium silicide deoxidation, while with aluminum deoxidation slightly higher aluminate levels were recorded. In most instances the globular type D inclusions were < 6 fo 9 microns in diameter

and similar to the modified inclusion types observed after conventional calcium ladle modification. Author

**N84-21719*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ION-BEAM NITRIDING OF STEELS**
Joshua Salik 13 Apr. 1984 15 p refs Presented at 11th Intern. Conf. on Met. Coatings, San Diego, Calif., 9-13 Apr. 1984; sponsored by American Vacuum Society
(NASA-TM-83599; E-1992; NAS 1.15:83599) Avail: NTIS HC A02/MF A01 CSCL 11F

The application of the ion beam technique to the nitriding of steels is described. It is indicated that the technique can be successfully applied to nitriding. Some of the structural changes obtained by this technique are similar to those obtained by ion nitriding. The main difference is the absence of the iron nitride diffraction lines. It is found that the dependence of the resultant microhardness on beam voltage for super nitralloy is different from that of 304 stainless steel. E.A.K.

**N84-21720*#** Research Inst. of Colorado, Fort Collins.
**PHOTODEPOSITION OF NITRIDE INSULATORS ON 3-5 SUBSTRATES Annual Report, 1 Apr. 1983 - 31 Mar. 1984**
George J. Collins 31 Mar. 1984 17 p
(Contract NCC3-28)
(NASA-CR-173393; NAS 1.26:173393) Avail: NTIS HC A02/MF A01 CSCL 11F

Laser assisted chemical vapor deposition (LCVD) of nitride insulators, using an excimer laser operating on either KrF or ArF transitions (248 nm or 193 nm respectively) was explored. The properties of silicon nitride films Deposited with 193 nm photons on quartz and silicon substrates in a SiH4, NH3, N2 and He mixture are discussed. Aluminum films were deposited at substrate temperatures from room temperature to 200 C using 248 nm or 193 nm photons to dissociate trimethylaluminum (TMA). Deposition of Al films were investigated to isolate problems associated with TMA such as C and O contamination during AlN depositions. The Al film properties were evaluated on SiO2 and Si substrates. Preliminary results were obtained for aluminum nitride films using TMA and NH3 as the gas phase Al and N donors. The properties of Cr films deposited over areas > 5 square cm using 193 nm or 248 nm photons to dissociate Cr(CO) were investigated. Author

**N84-21721*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**FRICTION AND WEAR OF NICKEL IN SULFURIC ACID**
George W. P. Rengstorff (Toledo Univ., Ohio), Kazuhisa Miyoshi, and Donald H. Buckley Apr. 1984 17 p refs
(Grant NAG3-276)
(NASA-TP-2290; E-1817; NAS 1.60:2290) Avail: NTIS HC A02/MF A01 CSCL 11F

Experiments were conducted with elemental nickel sliding on aluminum oxide in aerated sulfuric acid in concentrations ranging from very dilute (10 -4 N, i.e., 5 ppm) to very concentrated (96 percent) acid. Load and reciprocating sliding speeds were kept constant. With the most dilute concentration (10 -4 N) no observable corrosion occurred in or outside the wear area. This was used as the base condition to determine the high contribution of corrosion to total wear loss at acid concentrations between 0.5 percent (0.1 N) and 75 percent. Corrosion reached a maximum rate of 100 millimeters per year at 30 percent acid. At the same time, general corrosion outside the wear area was very low, in agreement with published information. It is clear that friction and wear greatly accelerated corrosion in the wear area. At dilute concentrations of 0.001 and 0.01 N, corrosion in the wear area was low, and general corrosion outside was also low, but local outside regions in the direction of the wear motion experienced some enhanced corrosion, apparently due to fluid motion of the acid. Author

**N84-21722#** Oregon Graduate Center for Study and Research, Beaverton.
**ANALYSIS OF MICROSTRUCTURE AND STRENGTHENING MECHANISMS IN LASER SURFACE ALLOYED Fe-Cr AND Fe-C-Cr ALLOY SYSTEMS Final Report, 8 Jul. 1980 - 31 Oct. 1983**
William E. Wood 22 Dec. 1983 29 p
(Contract DAAG29-80-K-0023)
(AD-A137971; ARO-16916-7-MS) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of rapid melting and subsequent quenching on the solidification behavior and solid state transformation structures of laser surface alloyed Fe-Cr, Fe-Ni, Fe-Cr-Ni and Fe-C-Cr systems were investigated as functions of composition (0-50%Cr, 0-20%Ni, 0-20%Cr/Ni, 0-1C%) and cooling rate. The microstructures were characterized by optical, scanning and thin foil transmission electron microscopy. The effects of laser parameters (laser power, beam size and scan rate) and coating variables (composition, thickness and morphology) on the penetration depth and melt width were also evaluated. The microstructures of Fe-Cr alloys were ferritic in nature, irrespective of the composition (0-50%Cr) and cooling rate. The transformation structures of Fe-5%Ni and Fe-6%Cr-2%Ni alloys exhibited a mixture of martensite and ferrite. The transformation structures of Fe-C-Cr alloys were studied as functions of the carbon (0.2-1.0%C) and chromium contents (0-40%Cr). The rapid solidification effects including the retention of supersaturated austenite, lack of carbide precipitation and the morphology of phases are discussed as functions of alloy content and cooling rate. GRA

**N84-21723#** Brown Univ., Providence, R. I. Engineering Materials Research Lab.
**CREEP AND CREEP RECOVERY OF 2618-T61 ALUMINUM UNDER VARIABLE TEMPERATURE**
U. W. Cho (Missouri Univ., Columbia) and W. N. Findley Oct. 1983 25 p
(Contract DAAG29-81-K-0138)
(AD-A137976; EMRL-89; TR-3) Avail: NTIS HC A02/MF A01 CSCL 11/6

Creep and creep recovery data are reported for pure tension of 2618 aluminum alloy under variable temperature between 200 deg. C and 230 deg. C. Varying temperature experiments involved an abrupt temperature increase and a linearly increasing and decreasing temperature at a constant stress of 137.9 MPa (20 ksi). A temperature-compensated time by Sherby and Dorn was employed to represent the effect of temperature. The temperature history dependent theory described the test data quiet well for both increasing and decreasing temperature. The apparent activation energy of this alloy was found to be 49,000 cal/mole. GRA

**N84-21724#** Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
**CYCLIC DEFORMATION AND FATIGUE OF MONOCRYSTALLINE NI-BASE SUPERALLOYS Final Report, 1 May 1982 - 1 Oct. 1983**
Campbell Laird 16 Dec. 1983 18 p
(Contract DAAG29-82-K-0014)
(AD-A138052; ARO-18856.4-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

A report is provided of progress in studying cyclic deformation of precipitation-hardened alloy in a project supported by the Army. This work concentrated on the stability of precipitates under cyclic deformation (Al-Ag, Al-Cu systems) and the strain-localization behavior of alloys containing shearable precipitates (Al-Cu, 0'') and non-shearable precipitates (Al-Cu, 0'). Furthermore, the relationship of cyclic response in such simple systems to that of commercial alloy was also studied. The main results are reported. GRA

**N84-21725#** Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.
**THE ELECTRONIC STRUCTURE OF C(2X2)S/FE(100): S 3p-LEVEL DISPERSIONS AND LINEWIDTHS. REVISION Interim Report**
R. A. DiDio, E. W. Plummer, and W. R. Graham 17 Jan. 1984

18 p
(Contract N00014-79-C-0991)
(AD-A138124; AD-E440224; LRSM-TR-17-REV) Avail: NTIS HC A02/MF A01 CSCL 11/6

The electronic structure of segregated c(2x2)S/Fe(100) was determined using synchrotron radiation and angle-resolved photoemission. In addition to mapping the S 3p-derived energy bands, the lineshapes of the S photoemission features were correlated to their surface Brillouin zone position. The dispersions of the bands derived from in-planes S 3 Psub-X Psub y levels are induced by S-S interactions, and are all described by a tight-binding model. The S 3pz-derived band is anomalously wide (1.2eV) compared to the tight-binding width, which is a substrate-induced effect. GRA

**N84-21726#** Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
**SEGREGATION OF Si AND Sn TO THE Fe(100) SURFACE IN THE Fe-6.2% Si-0.03% Sn ALLOY Interim Report**
Y. X. Zhou, E. W. Plummer, and C. J. McMahon, Jr. 17 Jan. 1984 5 p Submitted for publication
(Contract N00014-79-C-0991; SR01391279)
(AD-A138154; TR-21) Avail: NTIS HC A02/MF A01 CSCL 11/6

Surface segregation of Si and Sn and the site composition between them in a polycrystalline sample of an Fe-6.2% Si-0.03% Sn alloy were reported in a previous work by the authors. In the experiments reported here a single crystal having the same composition as the polycrystalline sample was used. The following temperature dependence of segregation on the (100) surface was observed. At lower temperatures (25-400 C) segregated to the surface. After heating at 500 C for 20 hours, Si was the only solute segregated to the (100) surface. At 600 C Sn segregated to the surface and replaced all the segregated Si on the surface. GRA

**N84-21727#** Brown Univ., Providence, R. I. Div. of Engineering.
**ANALYSIS OF SHEAR STRAIN LOCALIZATION IN THERMAL VISCO-PLASTIC MATERIALS**
T. G. Shawki, R. J. Clifton, and G. Majda Oct. 1983 104 p
(Contract DAAG29-81-K-0121)
(AD-A138186; TR-3; ARO-18414.2-EG) Avail: NTIS HC A06/MF A01 CSCL 11/6

Simple shearing deformations are analyzed as a means of investigating the effects of strain hardening, thermal softening, and strain-rate sensitivity on the formation of shear bands. Linear stability analysis is conducted for perturbations from homogeneous, time varying deformations. Finite difference solutions are obtained for the fully nonlinear system of governing equations. Velocity boundary conditions are emphasized although solutions for the case of stress conditions are also presented. Three types of constitutive models are considered: the power law model, the Arrhenius law, and the Bodner-Merzer model. Inertia and heat conduction are included. Qualitative features of plastic response for the class of problems considered are illustrated by eighteen numerical solutions. Low strain hardening high thermal softening, and weak strain-rate sensitivity all contribute to shear strain localization. The size of an initial perturbation is important in the stability of solutions for the case of velocity boundary conditions, but it is less important for stress boundary conditions because of the inherent inhomogeneity of dynamic solutions in the latter case. GRA

**N84-21728#** Dayton Univ., Ohio. Research Inst.
**A STUDY OF THE MAGNETIC AND METALLURGICAL PROPERTIES OF Sm(Co,Fe,Cu, Zr) SUB Z ALLOYS NEAR Z = 8.5 Final Report, 16 Jul. 1981 - 31 Oct. 1983**
A. E. Ray 7 Feb. 1984 18 p
(Contract DAAG29-81-K-0120)
(AD-A138253; UDR-TR-84-08; ARO-17973.4-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

Alloys corresponding to the compositions Sm(Co,Fe,Cu,Zr) have been characterized magnetically and metallurgically. Very large intrinsic coercivities combined with saturation inductions have been obtained for the bulk alloys. If these properties can be incorporated into sintered permanent magnets, energy products should be possible for temperature compensated alloys, and uncompensated alloys. The Sm(Co,Fe,Cu,Zr) alloys were found to behave metallurgically like alloys with similar transition metal content. They form a single phase solid solution at high temperatures which is retained at room temperature by rapid quenching; on reheating to approximately 800 deg. C, the high temperature phase dissociates by a spinodal-like reaction into a cellular microstructure consisting of 2:17 R cells, 1:5 cells and a platelet phase. All phase boundaries are coherent. The platelet phase was determined to have the 2:17 H crystal structure but also Sm-depleted of 2:17 stoichiometry. By comparing lattice constants of the multicomponent alloys with those of Sm2(Co1-xFex)17 alloys at the same Fe levels, it was determined that Zr-vacancy pairs substitute for Fe pairs at the dumbbell sites in the 2:17 R phase at high temperatures. GRA

**N84-21729#** Northeastern Univ., Boston, Mass. Inst. of Chemical Analysis and Materials Science.
**METASTABLE TRANSITION METAL ALLOYS PRODUCED BY RAPID QUENCHING: STRUCTURE AND PROPERTIES Final Report, 1 Apr. 1976 - 30 Jun. 1980**
B. C. Giessen Jan. 1984 114 p
(Contract N00014-76-C-0820)
(AD-A138296) Avail: NTIS HC A06/MF A01 CSCL 11/2

Metastable transition metal alloys, primarily, metallic glasses, were prepared by rapid solidification processing (melt spinning and arc-furnace hammer-and-anvil quenching); appropriate properties of these alloys were investigated. Specifically, glassy alloys containing transition metals such as Ti, Zr, Nb, Ta, Ni, Rh and Ir, as well as metals such as U, Ca and Cu and non-metallic additives such as O were studied; many of these glasses were prepared in this program for the first time. Properties studied included thermal stability (glass transition temperature and crystallization temperature), elastic modulus (measured by a newly adapted dynamic technique of impulse induced resonance), microhardness, and electrical transport (resistivity and thermoelectricity). Alloy constitution was studied. Rules for the prediction of ready glass formation based on alloy properties were formulated; a universal correlation between microhardness and elastic modulus was described. A new multilayer melt spinning technique was implemented. Nineteen publications resulted from this program and are listed in the report. Author (GRA)

**N84-21730#** Colorado School of Mines, Golden. Dept. of Metallurgical Engineering.
**CARBIDE FORMATION AND FRACTURE OF HIGH CARBON STEEL Final Report, Jan. 1981 - Nov. 1983**
G. Krauss 13 Feb. 1984 8 p
(Contract DAAG29-81-K-0030)
(AD-A138519; ARO-17653.8-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report briefly summarizes the research performed to characterize the fracture of hardened high carbon steels and the formation of carbides during the austenitizing, quenching, and tempering stages of the hardening heat treatments applied to high carbon steels. Four fracture mechanisms and morphologies, each associated with a different type of carbide distribution, were observed and correlated to fracture toughness. Details of findings are presented in the twelve (12) publications resulting from this research. Author (GRA)

**N84-21731#** Stanford Univ., Calif. Dept. of Materials Science and Engineering.
**MODELLING OF DEFORMATION AND FRACTURE IN HIGH-TEMPERATURE STRUCTURAL MATERIALS Annual Progress Report, 1 Mar. 1982 - 31 Jan. 1983**
Alan K. Miller 31 Jan. 1983 94 p refs
(Contract DE-AT03-76ER-70057)
(DE84-006452; SU-DMS-83-R-2) Avail: NTIS HC A05/MF A01

Research progress is reported under the following headings:

modeling of fatigue fracture, modeling of strain softening and strain localization, modeling of multiaxial flow behavior, and development of a physical basis for calculating the MATMOD constants for alloys. DOE

**N84-21732#** Los Alamos Scientific Lab., N. Mex.
**EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES OF A U5.7Nb ALLOY**
P. E. Armstrong , J. B. Straw , and G. L. Powell (Oak Ridge Y-12 Plant) Dec. 1983 22 p refs
(Contract W-7405-eng-36)
(DE84-006679; LA-9870) Avail: NTIS HC A02/MF A01

Hydrogen was added to samples from one lot of U5.7Nb alloy, gy gamma-phase annealing under different hydrogen overpressures and with water quenching from the annealing atmosphere. Uniaxial and biaxial tensile properties at strain rates of 0.001 per second and 2000 per second were determined for this alloy in the gamma-quenched state. The presence of hydrogen reduced ductility under all test conditions, but the fracture mode remained that of the ductile dimple type. As determined by scanning electron microscopy, dimple size decreased with increasing hydrogen content. DOE

**N84-21733#** Bendix Corp., Kansas City, Mo.
**PROCESS FOR PRODUCING PARTS WITH DEEP POCKETED PRECISION CAVITIES USING P/M SHAPE TECHNOLOGY**
V. K. Chandhok (Crucible Research Center), J. H. Moll (Crucible Research Center), and M. G. Ulitchny Feb. 1984 11 p refs
Presented at the 113th Ann. Meeting of the Am. Inst. of Mining, Met. and Petroleum Engr., Los Angeles, 26 Feb. 1984
(Contract DE-AC04-76DP-00613)
(DE84-006566; BDX-613-3048; CONF-840218-2) Avail: NTIS HC A02/MF A01

Deep pocketed precision cavities are produced in P/M titanium parts using a hard ceramic core and hot isostatic pressing. The properties of a component case made using Ti-6Al-6V-2Sn powder met goal requirements of high strength and good ductility. The application of the process to other materials and shapes was demonstrated. DOE

**N84-21734#** Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
**ENVIRONMENTAL REACTIONS AND THEIR EFFECTS ON MECHANICAL BEHAVIOR OF METALLIC MATERIALS Final Report**
Ronald Gibala Jan. 1984 20 p refs
(Contract DE-AC02-79ER-10359)
(DE84-005768; DOE/ER-10359/51) Avail: NTIS HC A02/MF A01

The results of research performed under DOE Contract No. DE-AC02-79ER10359 during the entire period of support from February 1, 1968 - August 31, 1982 are summarized. Significant contributions were made in the following research areas: (1) characterization of interstitial solutes and defect interactions in metals by internal friction techniques; (2) interstitial and substitutional solid solution hardening and softening behavior of body-centered cubic metals; (3) effects of hydrogen on mechanical behavior of body-centered cubic metals, including steels; (4) effects of surface oxide films and solute gradients on mechanical behavior of body-centered cubic metals. The results obtained in this research have been presented in approximately eighty technical presentations, fourteen student theses, and nearly fifty technical publications. Brief descriptions of each of the major projects areas are given. DOE

**N84-21735#** National Bureau of Standards, Washington, D.C.
**STANDARD REFERENCE MATERIAL CONTAINING 2.5 PERCENT AUSTENITE (SRM 488) Final Report**
G. E. Hicho and E. E. Eaton Dec. 1983 26 p refs
(PB84-143296; NBS-SP-260-86; LC-83-600613) Avail: NTIS HC A03/MF A01 CSCL 07D

This Standard Reference Material, SRM 488, is intended for the calibration of X-ray diffraction equipment used in determining the amount of retained austenite in hardened steels. The SRM was produced using powder metallurgical techniques and involved blending 2 1/2 percent by weight AISI type 310 stainless steel powder (austenitic) with AISI type 430 stainless steel powder (ferritic). From this blend, 389 compacts were produced and subsequently examined for nickel content by X-ray fluorescence spectrometry. A calibration curve was established using 13 compacts randomly selected from the population of 389. The curve relates the weight percent nickel obtained from X-ray fluorescence measurements to the volume percentage austenite as determined by quantitative microscopy measurements of the area percent. The curve was then used to assign the certified values to the remaining compacts. Author (GRA)

**N84-21736#** Battelle Pacific Northwest Labs., Richland, Wash.
**MEXAMS (METALS EXPOSURE ANALYSIS MODELING SYSTEM) Final Report, Sep. 1981 - Aug. 1983**
A. R. Felmy, S. M. Brown, Y. Onishi, S. B. Yabusaki, and R. S. Argo Feb. 1984 185 p refs
(Contract EPA-68-03-3089)
(PB84-157155; EPA-600/3-84-031; EPA-68-03-3089) Avail: NTIS HC A09/MF A01 CSCL 13B

MEXAMS, the Metals Exposure Analysis Modeling System, provides an enhanced capability for assessing the impact of priority pollutant metals on aquatic systems. It allows the user to consider the complex chemistry affecting the behavior of metals in conjunction with the transport processes that affect their migration and fate. This is accomplished by linking MINTEQ, a geochemical model, with EXAMS, an aquatic exposure assessment model. MINTEQ is a thermodynamic equilibrium model that computes aqueous speciation, adsorption and precipitation/dissolution of solid phases. It has a well-documented thermodynamic data base that contains equilibrium constants and other accessory data for seven priority pollutant metals: arsenic, cadmium, copper, lead, nickel, silver and zinc. The model was developed by combining the best features of two other existing geochemical models MINEQL and WATEQ3. Author (GRA)

**N84-21497#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**THE CORROSION-FATIGUE COOPERATIVE TESTING PROGRAMME**
Henri P. vanLeeuwen *In its* AGARD Highlights, Sep. 1982 Aug. 1982 p 6-7 refs (For primary document see N84-21496 12-01)
Avail: NTIS HC A02/MF A01

**N84-21634#** Joint Publications Research Service, Arlington, Va.
**MICROSTRUCTURE OF ALUMINUM ALLOY IN EARLY STAGES OF SPALLING Abstract Only**
V. I. Romanchenko, O. I. Marusiy, and I. V. Kramarenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 1 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 84-87 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21635#** Joint Publications Research Service, Arlington, Va.
**FRACTURE OF ALUMINUM IN UNIAXIAL AND BIAXIAL EXTENSION AT 473-77 DEG K Abstract Only**
I. Ye. Kurov, N. N. Demikhovskaya, G. I. Shakhalova, and S. M. Shevchenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 1-2 Transl. into ENGLISH from Fiz. Metallov i Metalloved. (Sverdlovsk, USSR), v. 56, no. 3, Sep. 1983 p 593-599 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21639#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF ELECTRON IRRADIATION ON RELAXATION OF TENSION IN ALUMINUM AND ALUMINUM ALLOYS Abstract Only**
L. N. Bystrov and M. Ye. Reznitskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 5-6 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow),

no. 5, Sep. - Oct. 1983 p 89-92 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21640#** Joint Publications Research Service, Arlington, Va.
**SPECIFICS OF STRUCTURE FORMATION IN NITRIDES SYNTHESIZED BY LASER ACTION ON METALS Abstract Only**
N. N. Rykalin, A. A. Uglov, V. A. Grebennikov, and M. B. Ignatyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 6 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 272, no. 5, Oct. 1983 p 1110-1114 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21641#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF AGING IN MARTENSITE STATE ON MECHANICAL PROPERTIES OF Cu-Al-Zn SYSTEM BETA-ALLOY Abstract Only**
O. G. Zotov, S. Yu. Kondratyev, G. Ya. Yaroslavskiy, B. S. Chaykovskiy, and V. V. Matveyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 21 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 81-83 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21643#** Joint Publications Research Service, Arlington, Va.
**OBTAINING METALLIC POWDERS BY ULTRASONIC ATOMIZATION OF MELTS Abstract Only**
Sh. M. Sheykhaliyev and S. I. Popel *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 27 Transl. into ENGLISH from Poroshkovay Met. (Kiev), no. 10, Oct. 1983 p 18-24 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21645#** Joint Publications Research Service, Arlington, Va.
**OBTAINING TITANIUM CARBIDE POWDER FROM TITANIUM SHAVINGS Abstract Only**
S. S. Kiparisov, Yu. V. Levinskiy, O. V. Padalko, and A. P. Petrov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 28 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1983 p 24-28 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21647#** Joint Publications Research Service, Arlington, Va.
**STRENGTH OF HARD ALLOY ELEMENTS OF HIGH PRESSURE APPARATUS FOR SYNTHESIS OF SUPERHARD MATERIALS Abstract Only**
N. V. Novikov, A. A. Lebedev, M. G. Loshak, V. M. Fridman, and V. S. Belinskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 30 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 58-64 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21648#** Joint Publications Research Service, Arlington, Va.
**INTERRELATIONSHIP BETWEEN TEMPERATURE INTERVALS OF INVERSE MARTENSITE TRANSFORMATION AND SHAPE RESTORATION IN TITANIUM NICKELIDE-BASED ALLOYS Abstract Only**
N. F. Zhebyneva, D. B. Chernov, V. N. Khachin, and V. E. Gyunter *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 31 Transl. into ENGLISH from Fiz. Metallov i Metalloved. (Sverdlovsk, USSR), v. 56, no. 3, Sep. 1983 p 521-525 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21649#** Joint Publications Research Service, Arlington, Va.
**MARTENSITE TRANSFORMATION AND SHAPE MEMORY IN TI0.5NI0.5-XPd SUB X SYSTEM ALLOYS Abstract Only**
V. P. Sivokha, A. S. Savvinov, V. P. Voronin, and V. N. Khachin *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 32 Transl. into ENGLISH from Fiz. Metallov i Metalloved. (Sverdlovsk, USSR), v. 56, no. 3, Sep. 1983 p 542-546 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21650#** Joint Publications Research Service, Arlington, Va.
**FLUCTUATIONS IN CHEMICAL COMPOSITION OF TITANIUM ALLOY BETA-SOLID SOLUTION IN PRESEPARATION STAGE**
A. A. Alekseyev, O. S. Korobov, A. B. Notkin, L. A. Smolyakova, and A. D. Shestakov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 32-33 Transl. into ENGLISH from Fiz. Metallov i Metalloved. (Sverdlovsk, USSR), v. 56, no. 3, Sep. 1983 p 515-520 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21657#** Joint Publications Research Service, Arlington, Va.
**SUPERFINE WIRE MADE FROM NEW ALLOY**
I. Konstantinova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 441-42 Transl. into ENGLISH from Sots. Industriya (Moscow), 15 Dec. 1983 p 4 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21662#** Joint Publications Research Service, Arlington, Va.
**SPECIFICS OF PROCESSES OF DEFORMATION AND MICROFRACTURE OF AMORPHOUS IRON-BASED ALLOYS Abstract Only**
O. L. Utevskaya, A. M. Glezer, M. M. Kantor, V. N. Kolotinskiy, and B. V. Molotilov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 45 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 272, no. 5, Oct. 1983 p 1114-1118 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

# 27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

**N84-21737** Beratungsgesellschaft fuer Mineraloel Anwendungstechnik m.b.H., Hamburg (West Germany).
**RESEARCH ON SHEAR STABILITY OF POLYMER-CONTAINING HYDRAULIC OILS [UNTERSUCHUNGEN ZUR SCHERSTABILITAET VON POLYMERHALTIGEN HYDRAULIKOELEN]**
Peter Neudoerfl and Harry Poth Nov. 1983 19 p refs In GERMAN; ENGLISH summary Presented at Conf., Hohenheim, West Germany, 9 Mar. 1983
(Rept-11; ISSN-0341-1893) Copyright. Avail: Issuing Activity

Mechanical degradation mechanisms of nonassociating polymers in solution are presented. Ultrasonic tests, vane pump tests, shear stability tests, and fuel injection pump tests were performed to determine the shear stability of hydraulic oils. Results prove that the fuel injector rig is not an appropriate test method for hydraulic oils. A simple gear pump test correlates quite well with field test results with a digger. Author (ESA)

**N84-21738** Beratungsgesellschaft fuer Mineraloel Anwendungstechnik m.b.H., Hamburg (West Germany).
**VISCOMETRIC CHANGES OF ENGINE OILS [VISKOMETRISCHE VERAENDERUNGEN VON MOTORENOELEN IM GEBRAUCH]**
Kurt K. Rumph Dec. 1983 23 p In GERMAN; ENGLISH summary Presented at Conf., Hohenheim, West Germany, 10 Mar. 1983
(Rept-12; ISSN-0341-1893) Copyright. Avail: Issuing Activity

Oxidation, aging, soot contamination, evaporation, fuel dilution, and polymer degradation (multigrade oils) of engine oils are dealt with. By means of used oil analyses it is shown that each of these processes results in a different individual change of the viscosity properties. Author (ESA)

**N84-21739*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**CHARACTERIZATION AND MEASUREMENT OF POLYMER WEAR**

Donald H. Buckley and Paul R. Aron 11 Apr. 1984 17 p refs Presented at Intern. Symp. on Polymer Wear and its Control, St. Louis, 9-11 Apr. 1984; sponsored by American Chemical Society (NASA-TM-83628; E-2033; NAS 1.15:83628) Avail: NTIS HC A02/MF A01 CSCL 11G

Analytical tools which characterize the polymer wear process are discussed. The devices discussed include: visual observation of polymer wear with SEM, the quantification with surface profilometry and ellipsometry, to study the chemistry with AES, XPS and SIMS, to establish interfacial polymer orientation and accordingly bonding with QUARTIR, polymer state with Raman spectroscopy and stresses that develop in polymer films using a X-ray double crystal camera technique. E.A.K.

**N84-21740*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**OVERVIEW OF ZIRCONIA WITH RESPECT TO GAS TURBINE APPLICATIONS**

James D. Cawley Mar. 1984 29 p refs

(NASA-TP-2286; E-1726; NAS 1.60:2286) Avail: NTIS HC A03/MF A01 CSCL 11G

Phase relationships and the mechanical properties of zirconia are examined as well as the thermal conductivity, deformation, diffusion, and chemical reactivity of this refractory material. Observations from the literature particular to plasma-sprayed material and implications for gas turbine engine applications are discussed. The literature review indicates that Mg-PSZ (partially stabilized zirconia) and Ca-PSZ are unsuitable for advanced gas turbine applications; a thorough characterization of the microstructure of plasma-sprayed zirconia is needed. Transformation-toughened zirconia may be suitable for use in monolithic components. A.R.H.

**N84-21741*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**A PROBABILISTIC ANALYSIS OF SILICON COST**

Leonard J. Reiter 15 Nov. 1983 25 p refs Sponsored in part by DOE

(Contract DE-AI01-76ET-20356)

(NASA-CR-173461; JPL-5101-246; JPL-Pub-83-94; DOE/JPL-1012/93; NAS 1.26:173461) Avail: NTIS HC A02/MF A01 CSCL 11G

Silicon materials costs represent both a cost driver and an area where improvement can be made in the manufacture of photovoltaic modules. The cost from three processes for the production of low-cost silicon being developed under the U.S. Department of Energy's (DOE) National Photovoltaic Program is analyzed. The approach is based on probabilistic inputs and makes use of two models developed at the Jet Propulsion Laboratory: SIMRAND (SIMulation of Research ANd Development) and IPEG (Improved Price Estimating Guidelines). The approach, assumptions, and limitations are detailed along with a verification of the cost analyses methodology. Results, presented in the form of cumulative probability distributions for silicon cost, indicate that there is a 55% chance of reaching the DOE target of $16/kg for silicon material. This is a technically achievable cost based on expert forecasts of the results of ongoing research and development and do not imply any market prices for a given year. Author

**N84-21742#** Wisconsin Univ., Madison. Dept. of Chemical Engineering.

**PROPERTIES OF POLYURETHANE ANIONOMERS: IONIZATION VIA BIMOLECULAR NUCLEOPHILIC DISPLACEMENT OF THE URETHANE HYDROGEN Interim Technical Report**

K. K. S. Hwang, T. A. Speckhard, and S. L. Cooper 1 Feb. 1984 33 p Submitted for publication

(Contract N00014-83-K-0423)

(AD-A137988; TR-2) Avail: NTIS HC A03/MF A01 CSCL 11/9

Two series of polyether polyurethane anionomers based on 4,4' diphenylmethane diisocyanate (MDI) and polytetramethylene oxide (PTMO) were synthesized and their properties investigated. Ionization proceeded via a biomolecular nucleophilic displacement reaction with sodium hydride followed by a ring opening reaction with gamma-propane sultone. The lower hard segment content (20 wt% MDI) control material exhibited an initial one phase morphology that underwent phase separation upon ionization with subsequent development of hard segment ordering. These changes in morphology were accompanied by dramatic improvements in mechanical properties. The 38 wt% MDI control material possessed a two phase morphology and well developed hard segment ordering. Ionization disrupted the hard segment ordering and at low levels decreased the degree of phase separation. Further ionization led to reattainment of the original degree of phase separation and a marked improvement in mechanical strength. The differences in properties of the two series of materials are discussed and compared with properties of other polyurethane ionomers reported in the literature. GRA

**N84-21743#** Naval Research Lab., Washington, D. C.

**HIGH-TEMPERATURE DEUTERATED LUBRICANTS: ADDITIVES, MECHANISMS, AND METHODS Interim Report**

J. E. Campana 30 Dec. 1983 25 p

(F43-433)

(AD-A138114; NRL-8779) Avail: NTIS HC A02/MF A01 CSCL 11/8

The purpose of this report is to identify fundamental and applied research related to the deuterated lubricant approach required to develop oxidatively stable, high-temperature lubricants. This report presents a brief history and overview of the Navy's deuterated lubricant research. Two pertinent chemical effects on lubrication performance are reviewed - the deuterium isotope effect and lubricant additive effects. Finally, future research needs related to deuterated lubricants are presented in detail. Author (GRA)

**N84-21744#** Northwestern Univ., Evanston, Ill.

**MICROWAVE SINTERING OF CERAMICS Final Report, 1 Jul. 1980 - 30 Sep. 1983**

D. L. Johnson and M. E. Broadwin Feb. 1984 19 p

(Contract DAAG29-80-K-0031)

(AD-A138402; ARO-17377.1-MS) Avail: NTIS HC A02/MF A01 CSCL 13/8

A single mode cavity microwave sintering apparatus was designed, constructed and utilized to investigate sintering of a number of oxide ceramics. A temperature feedback system was designed and incorporated. Rapid passthrough sintering of Beta-alumina rods produced high densification rates and fine grain sizes. Mathematical modeling of the loaded cavity was commenced. Through this, it is possible to predict the specimen temperature from non-electrical, dielectric and geometric parameters. GRA

**N84-21745#** Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.

**THE RELATIONSHIP OF ENGINEERING PROPERTIES TO THE MOLECULAR STRUCTURE OF POLYMERIC MATERIALS: DAMAGE ACCUMULATION PROCESSES Final Report, 1 Feb. 1978 - 31 Aug. 1983**

J. O. Brittain Feb. 1984 6 p

(Contract N00014-78-C-0276)

(AD-A138411; Rept-6) Avail: NTIS HC A02/MF A01 CSCL 11/9

Research was conducted on Epoxy resins, the low temperature relaxation spectra of six epoxy resins was determined via thermally stimulated depolarization measurements. The effect of cross-linking and aging upon physical properties and fracture phenomena has been ascertained for the epoxy resin systems diglycidyl ether of butanediol, DGEB and 4-4' diaminodiphenyl sulfone, DDS. Author (GRA)

**N84-21746#** Electrochemical Technology Corp., Seattle, Wash.

**DETERMINATION OF THE EFFECT OF COMPOSITION, STRUCTURE AND ELECTROCHEMICAL MASS TRANSPORT PROPERTIES ON ADHESION AND CORROSION INHIBITION OF PAINT FILMS Final Report, 1 Nov. 1981 - 31 Dec. 1983**

T. R. Beck and R. T. Ruggeri Dec. 1983 105 p

(Contract N00014-82-C-0052)
(AD-A138487; ETC-81-50) Avail: NTIS HC A06/MF A01 CSCL 11/3

The transport of sodium and chloride ions and water through six unpigmented paints has been investigated experimentally using a radiotracer method. A previously proposed mass transport model of paints was inadequate to explain the experimental observations. A new mass transport model is proposed and tested. Qualitative agreement between the new model and the experiments is achieved when the effective dielectric constant of the paint is increased above the observed value. A gravametric microbalance technique was used to determine the sorption of water by four types of paint. Both steady state and transient conditions have been investigated. These experiments show that both the solubility and diffusivity depend on the specimen thickness. The results are interpreted in terms of a two-phase paint layer which preferentially absorbs water near the paint-metal interface.
Author (GRA)

**N84-21747#** Rockwell International Corp., Thousand Oaks, Calif. Science Center.
**SINTERING PHENOMENA OF NON-OXIDE SILICON COMPOUNDS Research Summary Report, 1 Jan. - 31 Dec. 1983**
Fred F. Lange Jan. 1984 109 p refs
(Contract DE-AC03-78ER-01885)
(DE84-006599; DOE/ER-01885/T5) Avail: NTIS HC A06/MF A01

This report describes the technical progress made in an investigation of the influence powder processing has on the liquid phase sintering of silicon nitride ceramics. The past year's research has concentrated on three main areas. In the first of these a new task has been started to investigate the use of Si-S-N chemistry as an alternative route for producing high parity silicon nitride powders of controlled morphology. The second task has continued work to examine the effect green compact homogeneity has on the sintering process. Specifically the effect of a precipitation process, developed to improve the compositional homogeneity green compacts on the sintering of green nitride materials, has been examined. The experiments demonstrate that careful control of homogeneity can lead to a considerable enhancement of sintering, enabling materials to be fabricated at lower temperatures and using less additives. To complement the experimental work a theoretical study of how particle packing and compositional homogeneity influences the liquid phase sintering process has been initiated in a third task.
DOE

**N84-21748#** Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
**ASSESSMENT OF CERAMIC MATERIALS TECHNOLOGY FOR HEAT EXCHANGERS**
Jan. 1984 176 p refs
(Contract DE-AC07-76ID-01570)
(DE84-005748; EGG-SE-6367) Avail: NTIS HC A09/MF A01

The material property data and related test method, life prediction, and product reliability technology available for ceramic materials used in heat exchanger designs intended to conserve energy by preheating industrial furnace combustion air were assessed. Several candidate ceramic materials are discussed that have the potential to withstand the high temperatures and corrosive constituents of waste heat streams from industrial processes such as aluminum remelt, steel, and glass-making furnaces where metallic recuperators have problems. Currently available and emerging heat exchanger designs that were developed under joint funding agreements with the US Department of Energy (DOE) are reviewed and their operational problems are considered. In addition, the report identifies areas in which more information is needed.
DOE

**N84-21749#** Bendix Corp., Kansas City, Mo.
**STRESS RELAXATION OF CELLULAR SILICONE MATERIAL, 1983**
J. W. Schneider Feb. 1984 19 p refs
(Contract DE-AC04-76DP-00613)
(DE84-007103; BDX-613-3013) Avail: NTIS HC A02/MF A01

The long-term (10 years) stress relaxation properties of cellular silicone materials at room temperature are under evaluation. Both equilibrium (Union Carbide W-97, random copolymer) type base polymers are included. The equilibrium type material used urea as the leachable filler, while the condensation type material used ammonium chloride. Each material was compounded to yield densities of 0.34 and 0.52 g/cm(3) for thicknesses of 1.17, 1.52, and 2.54 mm. These density-thickness combinations were compressed to nominal compressions of 20 and 40 percent with nine replicated at each condition. A specially-designed fixture is used to maintain a specific compression on the cellular sample and a universal test machine is used to acquire the load data. Currently, the predicted load retention is between 59 and 67 percent of the original load.
DOE

**N84-21750#** California Univ., Livermore. Lawrence Livermore Lab.
**RING TENSILE TEST OF MODIFIED HALTHANE 88-2**
Ing L. Chiu 19 Dec. 1983 13 p refs
(Contract W-7405-eng-48)
(DE84-005891; UCID-19959) Avail: NTIS HC A02/MF A01

Seven adhesives, designated Halthanes, have been developed at the Lawrence Livermore National Laboratory. This research deals with the stress-strain behavior of Halthane 88-2 and a surfactant modified version of this adhesive as a function of aging time and temperature. The urethane adhesive, Halthane 88-2, consists of prepolymer 88, curing agent XU-205, FC-430, with 88/12/0.25 weight ratio, respectively. Ring tensile measurements were made on control samples and samples aged at elevated temperatures on a logarithmic time scale. The temperatures were 60(0)C, 75(0)C and 100(0)C, and aged for 3 days, 10 days, and 28 days.
DOE

**N84-21751#** Erlangen-Nuremberg Univ. (West Germany). Lehrstuhl Glas und Keramik.
**THERMAL DIFFUSION IN GLASS MELTS Final Report, Sep. 1982**
Rolf Moser, Helmut A. Schaeffer, and Gerhard Tomandl Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 63 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-83-033; ISSN-0170-1339) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13,50

Thermal diffusion with heavy ions in glasses at temperatures > transformation (Tg) point is studied. A disk-like sample of glass was heated from above and cooled from below. Mixed alkali glasses containing Rd cations and Cs cations were used. Concentration profiles were measured by energy dispersive analysis with X-rays (EDAX) using scanner electron microscopy, by microprobes, and for radioactive marked samples by autoradiography. These instationary profiles were computed theoretically. Linear temperature profiles show the best accordance with the measured ones. The heavier ion always moves to the cold end. This is also found in glasses containing two alkali metals with different concentration ratios. The differences of the heat of transport is between 2 and 14 KJ/mole. Disturbances by convection are not found. Thermal diffusion should not be a factor in the final storage of radioactive fission products in glass blocks, due to the long time for reaching the steady state.
Author (ESA)

**N84-21644#** Joint Publications Research Service, Arlington, Va.
**EXPERIMENTAL STUDY OF POWDER PRODUCTION PROCESS USING CENTRIFUGAL ATOMIZATION Abstract Only**
A. G. Tsipunov, Yu. F. Ternovoy, S. B. Kuratchenko, and O. M. Kuimova *in its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 27-28 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1983 p 13-18 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21646#** Joint Publications Research Service, Arlington, Va.
**NITRATION OF INTERMETALLIDE TIAl3**
O. V. Pshenichnaya, P. A. Verkhovodov, P. S. Kislyy, M. A. Kuzenkova, and A. B. Goncharuk *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 28-29 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1983 p 76-80 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

# 28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

**N84-21752** Prins Maurits Lab. TNO, Rijswijk (Netherlands).
**THERMAL STABILITY OF DIETHYLENE GLYCOL DINITRATE (DEGN) PROPELLANT [THERMISCH STABILITEIT VAN DEGN-KRUIT]**
J. H. M. vanLiempt Apr. 1983 37 p refs In DUTCH; ENGLISH summary
(Contract A81/KL/039)
(PML-1983-22; TDCK-78389) Avail: Issuing Activity

The thermal stability of unpressed DEGN propellant, pressed DEGN propellant and a reference cellulose nitrate propellant was investigated. Heat generation was related to the results of accelerated aging experiments, classic stability tests, and chemical analysis. The influence of propellant pressing on thermal stability is determined. Both DEGN propellants exhibit good stability. A more limited investigation with the standard heat generation test suffices to determine the stability of this type of propellant.
Author (ESA)

**N84-21753#** Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
**FUEL EFFECTS ON GAS TURBINE ENGINE COMBUSTION Final Report, 31 Sep. 1981 - 1 Jan. 1983**
R. C. Ernst and D. Andreadis Wright-Patterson AFB, Ohio AFWAL Jun. 1983 90 p
(Contract F33615-81-C-2092; AF Proj. 3048)
(AD-A138385; PWA/GPD-FR-16616; AFWAL-TR-83-2048; AFESC/ESL-TR-83-65) Avail: NTIS HC A05/MF A01 CSCL 21/4

The objective of this study was to develop and/or improve correlations of fuel properties and engine design with combustion performance and hot section durability. The data base consisted primarily of fuel effect data obtained over the past four years under a number of DoD contracts. The approach taken was first to develop fuel effect correlations for specific combustor configurations, then to tie together these correlations using engine design parameters thereby allowing prediction of fuel effects in any current or future aircraft gas turbine combustion system. In most cases statistical analysis was used to identify the correlating variables. The relationships developed for individual combustors were then correlated with combustor design and operating parameters that were influence by fuel differences. GRA

**N84-21754#** Department of Energy, Bartlesville, Okla. Energy Technology Center.
**REVIEW OF STORAGE STABILITY CHARACTERISTICS OF HYDROCARBON FUELS, 1952-1982**
John W. Goetzinger, Charles J. Thompson, and Dennis W. Brinkman Oct. 1983 309 p refs
(DE84-006557; DOE/BETC/IC-83/3) Avail: NTIS HC A14/MF A01

This discussion and data compilation relating to the storage stability of hydrocarbon liquids is divided into four principal sections: (1) background narrative, (2) references, (3) summary table, and (4) data tables. The Background narrative section provides a general discussion of various types of storage stability tests arranged by type of sample involved. This generic review will provide an introduction for those new in the field or cited in this section to aid in further investigation. The second section is the References, consisting of an alphabetical listing of the literature cited along with an abstract for each entry. This section should provide additional details for anyone needing to use the data provided in the tables. Since many of the publications are difficult, if not impossible, to obtain today, these abstracts may have to suffice in place of the actual report. The third section, or Summary Table, serves as a multientry index for the approximately 230 tables of raw data to follow. Information has been grouped according to the type of material involved, such as gasoline, diesel, jet fuel, coal liquid, etc. DOE

**N84-21755#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
**VAPORIZATION OF SYNTHETIC FUELS Ph.D. Thesis - Final Report**
William A. Sirignano, S. C. Yao, A. Y. Tong, and D. Talley 1983 335 p refs
(Grant DE-FG22-81PC-40277)
(DE84-006556; DOE/PC-40277/T1) Avail: NTIS HC A15/MF A01

The problem of transient droplet vaporization in a hot convective environment is examined. The main objective of the present study is to develop an algorithm for the droplet vaporization which is simple enough to be feasibility incorporated into a complete spray combustion analysis and yet will also account for the important physics such as liquid-phase internal circulation, unsteady droplet heating and axisymmetric gas-phase convection. A simplified liquid-phase model has been obtained based on the assumption of the existence of a Hill's spherical vortex inside the droplet together with some approximations made in the governing diffusion equation. The use of the simplified model in a spray situation has also been examined. It has been found that droplet heating and vaporization are essentially unsteady and droplet temperature is nonuniform for a significant portion of its lifetime. It has also been found that the droplet vaporization characteristic can be quite sensitive to the particular liquid-phase and gas-phase models. The results of the various models are compared with the existing experimental data. No definite conclusion can be drawn based on the experimental data. DOE

**N84-21756#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**SOLID FUEL COMBUSTION CHAMBER Progress Report, Jan. - Jun. 1983**
H. F. R. Schoeyer, P. A. O. G. Korting, J. B. Vos, and J. P. M. Vermissen Jun. 1983 10 p refs Sponsored by Netherlands Foundation for Technical Research (STW), Project Office for Energy Research, Delft Univ. of Tech. and Prins Maurits Lab. TNO
(VTH-LR-392; PML-1982-128; PR-3) Avail: NTIS HC A02/MF A01

The financial, project management, experimental, and theoretical developments of an investigation of flow and combustion processes in a solid fuel grain are summarized. Author (ESA)

**N84-21757#** Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Ballistiques et Spatiaux.
**GUIDE FOR DESIGNING PYROTECHNICS SYSTEMS FOR PAYLOADS ON MANNED OR UNMANNED VEHICLES [GUIDE POUR LA CONCEPTION DES SYSTEMES PYROTECHNIQUES DESTINES AUX CHARGES UTILES EMBARQUEES SUR DES VEHICULES HABITES OU NON HABITES]**
Paris ESA 18 Aug. 1983 222 p In FRENCH
(Contract ESA-4860/81/NL-AK)
(SNIAS-NT-2-01(0); ESA-CR(P)-1835) Avail: NTIS HC A10/MF A01

Risks associated with spacecraft pyrotechnics are listed according to subsystems and payload operation phase. Guidelines for designing pyrotechnics components are provided. The design

of solar panel and an apogee motor pyrotechnics is outlined.
Author (ESA)

# 31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

**N84-21758** Engineering Sciences Data Unit, London (England).
**VALIDATED ENGINEERING DATA INDEX, 1983 - 1984**
[1983] 429 p
Avail: Issuing Activity

The Engineering Sciences Data Unit (ESDU) index provides a subject 'key word' listing of data items. Some of the major subject categories include: aerodynamics, tribology, structures, mechanisms, heat transfer, stress and strength, fatigue, heat transfer, wind engineering, fluid mechanics, and noise. M.G.

**N84-21759** Prins Maurits Lab. TNO, Rijswijk (Netherlands).
**INVESTIGATION OF THE USEFULNESS OF THE SMOKE GENERATOR DRAEGER MODEL MK V FOR FIRE SERVICES EXERCISES ONBOARD SHIPS [ONDERZOEK NAAR DE BRUIKBAARHEID VAN DE ROOKGENERATOR DRAEGER MODEL MK V TBV BRANDWEEROEFENINGEN AAN BOORD VAN SCHEPEN]**
J. Kaaijk Jan. 1983 13 p refs In DUTCH; ENGLISH summary (Contract A80/KM/109)
(PML-1983-6; TDCK-77822) Avail: Issuing Activity

The chemical composition and the combustibility of the fog produced by a smoke generator were analyzed. Aliphatic hydrocarbons, including the n-alkanes C15-C21 are found. Polycyclic aromatic hydrocarbons are not detected. The smoke can not be ignited. Author (ESA)

**N84-21760#** Maryland Univ., College Park. Dept. of Civil Engineering.
**DEVELOPMENT OF PROBABILISTIC RIGID PAVEMENT DESIGN METHODOLOGIES FOR MILITARY AIRFIELDS Final Report**
M. W. Witczak, J. Uzan, and M. Johnson Dec. 1983 210 p
(DA Proj. 4A1-61102-AT-22)
(AD-A138212; WES/TR/GL-83-18) Avail: NTIS HC A10/MF A01 CSCL 13/13

The current Corps of Engineers design procedures for rigid airfield pavements is based on the Westergaard free edge stress slab theory, and a proposed procedure is based on the multilayer elastic theory. These two design procedures have been expanded to airfield pavement designs expressed in probabilistic and reliability terms. Further developments were required in these procedures to make the analysis more practicable. Two major investigations were conducted: (1) Evaluation and use of the composite modulus of elasticity for layers beneath the rigid pavement, and (2) Evaluation of the maximum tensile stress at the bottom of the slab for different aircraft types. Derivations obtained from the investigation of the composite modulus and maximum tensile stress are reported and are included in computer programs for probabilistic/reliability analysis of rigid pavements. The approximate closed form (Taylor series expansion) is utilized. Example runs of the computer program are presented. GRA

**N84-21761#** Instituut TNO voor Werktuigkundige Constructies, Delft (Netherlands).
**MODELING BY MEANS OF NETWORKS [MODELVORMING DOOR MIDDEL VAN NETWERKEN]**
R. A. P. J. Schulze and W. R. vanWijk Apr. 1983 35 p In DUTCH; ENGLISH summary Presented at Algemene Voorwaarden voor Onderzoeks- en Ontwikkelingsopdrachtenaan TNO, the Hague, 1979
(Contract A80/KM/086)
(IWECO-5177401-83-1; TDCK-78515) Avail: NTIS HC A03/MF A01

The possibilities of the network theory for modeling of systems and processes containing mechanical installations are described. The basic elements constituting the processes are defined. The mathematical solution procedures for the various types of network are discussed. Author (ESA)

**N84-21762#** Transportation Research Board, Washington, D.C.
**MATERIAL CERTIFICATION AND MATERIAL-CERTIFICATION EFFECTIVENESS Final Report**
Nov. 1983 27 p refs Sponsored in part by American Association of State and Highway and Transportation Officials and Federal Highway Administration
(PB84-143270; TRB/NCHRP-/SYN-102) Avail: NTIS HC A03/MF A01 CSCL 13B

This synthesis is of interest to materials engineers and others concerned with procedures for assuring the quality of materials used in the construction of highway facilities. Detailed information is presented on various types of certification plans and on the characteristics that determine their degree of success. Highway agencies carry out procedures for inspection, testing, and evaluation of materials used in construction of their facilities. Some agencies employ certification acceptance as part of their quality assurance programs. This approach saves time and money as well as improves quality. Information on various approaches to material certification is included and the importance of verification of the validity of the certification by use of independent random sampling and testing is emphasized. GRA

**N84-21763#** Transportation Research Board, Washington, D.C.
**ENGINEERING FABRICS IN TRANSPORTATION CONSTRUCTION**
Scott C. Herman, ed. 1983 104 p refs
(PB84-144856; TRB/TRR-916; LC-83-26864; ISBN-0-3559-7; ISSN-0361-1981) Avail: NTIS HC A06/MF A01 CSCL 13B

The following areas are discussed: treatments for reduction of reflective cracking of asphalt overlays on jointed-concrete pavements in Georgia; laboratory testing of fabric interlayers for asphalt concrete paving: interim report; reflection cracking models: review and laboratory evaluation of engineering fabrics; optimum-depth method for design of fabric-reinforced unsurfaced roads; dynamic test to predict field behavior of filter fabrics used in pavement subdrains; mechanism of geotextile performance in soil-fabric systems for drainage and erosion control; permeability tests of selected filter fabrics for use with a loess-derived alluvium; geotextile filter criteria; use of fabrics for improving the placement of till on peat foundation; geotextile earth-reinforced retaining wall tests: Glenwood Canyon, Colorado; New York State Department of Transportation's experience and guidelines for use of geotextiles; evaluation of two geotextile installations in excess of a decade old; and, long-term in situ properties of geotextiles. GRA

**N84-21764#** Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
**RESEARCH PLANNING TASK GROUP STUDY-THERMAL DESTRUCTION Final Report**
Michael J. Binder and Roger A. Strehlow Jan. 1984 131 p refs (Grant EPA-R-806819)
(PB84-145119; EPA-600/2-84-025) Avail: NTIS HC A07/MF A01 CSCL 13B

The state-of-the-art of thermal destruction of industrial toxic wastes were determined, research needs in this area were identified and prioritized. Through a literature search, discussion with EPA personnel, discussions with authorities in the area of thermal destruction, and attendance at a national meeting on the subject, the state-of-the-art of thermal destruction of industrial toxic waste was determined, and research needs which are expected to provide useful results were identified. GRA

**N84-21765#** New England Apparel Manufacturers' Association, Inc., Fall River, Mass.
**MANUAL FOR IMPLEMENTING A SHARED TIME ENGINEERING PROGRAM (STEP) SEPTEMBER 1980 THROUGH SEPTEMBER 1983**
Harvey I. Aronoff, Janet J. Leslie, Arnold N. Mittleman, and Shan Holt (Public Administration Inst., N.Y.) Nov. 1983 143 p Spon-

sored in part by US Dept. of Commerce, Washington, D.C.
(PB84-144260) Avail: NTIS HC A07/MF A01 CSCL 13H

This manual describes a Shared Time Engineering Program (STEP) conducted by the New England Apparel Manufacturers Association (NEAMA) headquartered in Fall River Massachusetts, and funded by the Office of Trade Adjustment Assistance of the U.S. Department of Commerce. It is addressed to industry association executives, industrial engineers and others interested in examining an innovative model of industrial engineering assistance to small plants which might be adapted to their particular needs. GRA

# 32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

**N84-21766** Royal Signals and Radar Establishment, Malvern (England).
**POLARIMETRIC PRINCIPLES AND TECHNIQUES**
S. R. Cloude Oct. 1983 82 p refs
(AD-A139252; RSRE-MEMO-3615; BR90433) Copyright. Avail: Issuing Activity

The mathematical formulation of a polarimetric theory for radar scattering is outlined. Physical interpretation of fundamental results from the theory of nonsingular linear transformations and the general scattering problem treated as a geometrical transformation on the Poincare sphere are treated. Second order statistical effects in polarimetric scattering are introduced via the coherency matrix and Stokes vector. The matrix governing transformation of these second order parameters is related to the elements of the coherent scattering matrix. Author (ESA)

**N84-21767*#** Public Service Satellite Consortium, Washington, D.C.
**PACIFIC BASIN COMMUNICATIONS STUDY, VOLUME 1 Final Report, Sep. 1980 - Oct. 1981**
Elizabeth L. Young and Jane N. Hurd Oct. 1981 262 p refs Sponsored in part by National Telecommunications and Information Administration 2 Vol.
(Contract NASw-3488)
(NASA-CR-173173; NAS 1.26:173173) Avail: NTIS HC A12/MF A01 CSCL 17B

The Pacific Basin Communications Study describes and assesses extent telecommunications systems in the Pacific Islands region. The study examines user needs in terms of the development of social services and commercial activities. Alternative technological solutions to communications problems are proposed and described. Recommendations include the augmentation and improvement of existing systems allowing for increased communications capacity. Regional cooperation will be required to accommodate the specific, unique requirements of individual nations. Questions of financing, implementation, management, costs and benefits of a regional telecommunications system are discussed. Author

**N84-21768*#** Public Service Satellite Consortium, Washington, D.C.
**PACIFIC BASIN COMMUNICATION STUDY, VOLUME 2 Final Report, Sep. 1980 - Oct. 1981**
Elizabeth L. Young and Jane N. Hurd Oct. 1981 144 p refs Sponsored in part by National Telecommunications and Information Administration 2 Vol.
(Contract NASw-3488)
(NASA-CR-173174; NAS 1.26:173174) Avail: NTIS HC A07/MF A01 CSCL 17B

Users' meeting summary report, chronology of visits, economic data for forum countries, techniques used in the study, communication choices, existing resources in the Pacific Basin, and warc 79 region 3 rules and regulations were presented in volume 2. B.G.

**N84-21769#** Mitre Corp., Bedford, Mass.
**VOICE PREPROCESSING SYSTEM INCORPORATING A REAL-TIME SPECTRUM ANALYZER WITH PROGRAMMABLE SWITCHED-CAPACITOR FILTERS Final Report**
G. Knapp Jan. 1984 52 p
(Contract F19628-82-C-0001; AF Proj. 4130)
(AD-A137999; MTR-8677; ESD-TR-83-253) Avail: NTIS HC A04/MF A01 CSCL 17/2

As part of a speaker verification program for BISS (Base Installation Security System), a test system is being designed with a flexible preprocessing system for the evaluation of voice spectrum/verification algorithm related problems. The main part of this report covers the design, construction, and testing of a voice analyzer with 16 integrating real-time frequency channels ranging from 300 Hz to 3 KHz. The bandpass filter response of each channel is programmable by NMOS switched capacitor quad filter arrays. Presently, the accuracy of these units is limited to a moderate precision by the finite steps of programming. However, repeatability of characteristics between filter units and sections seems to be excellent for the implemented fourth-order Butterworth bandpass responses. We obtained a 0.1 dB linearity error of signal detection and measured a signal-to-noise ratio of approximately 70 dB. The proprocessing system discussed includes preemphasis filter design, gain normalizer design, and data acquisition system design as well as test results. Author (GRA)

**N84-21770#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**A RECURSIVE LINEAR PREDICTIVE VOCODER M.S. Thesis**
Willis A. Janssen Dec. 1983 367 p
(AD-A138008; AFIT/GE/EE/83D-33) Avail: NTIS HC A16/MF A01 CSCL 17/2

A non-real time 10 pole recursive autocorrelation linear predictive coding vocoder was created for use in studying effects of recursive autocorrelation on speech. The vocoder is composed of two interchangeable pitch detectors, a speech analyzer, and speech synthesizer. The time between updating filter coefficients is allowed to vary from .125 msec to 20 msec. The best quality was found using .125 msec between each update. The greatest change in quality was noted when changing from 20 msec/update to 10 msec/update. Pitch period plots for the center clipping autocorrelation pitch detector and simplified inverse filtering technique are provided. Plots of speech into and out of the vocoder are given. Formant versus time three dimensional plots are shown. Effects of noise on pitch detection and formants are shown. Noise effects the voiced/unvoiced decision process causing voiced speech to be re-constructed as unvoiced. Author (GRA)

**N84-21771#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**LIMITED CONTINUOUS SPEECH RECOGNITION BY PHONEME ANALYSIS M.S. Thesis**
A. Hussain 8 Dec. 1983 151 p
(AD-A138021; AFIT/GE/EE/83D-31) Avail: NTIS HC A08/MF A01 CSCL 17/2

A Limited Continuous Speech Recognition system is developed based upon phoneme analysis. 16 Bandpass filters are used to obtain the frequency components of the input speech. The input speech is broken into packets of 40 milliseconds each. These packets are compared with phonemes in a template file by a differencing of frequency magnitudes. The resulting phoneme string representation of the input speech is compressed and compared with strings in a library file for discrete word recognition. For continuous speech recognition the phoneme string is analyzed a phoneme at a time to construct word sequences. The word string which best matches the input phoneme string is recognized as the word sequence. The system has an accuracy of about 94% for discrete word recognition and about 80% for continuous

speech recognition. The vocabulary used is the digits zero to nine and point. Author (GRA)

**N84-21772#** Rome Air Development Center, Griffiss AFB, N.Y.
**SCATTERING EXPERIMENTS AT THE IPSWICH ELECTROMAGNETIC MEASUREMENTS FACILITY: CALIBRATION WITH PERFECTLY CONDUCTING SPHERES**
R. V. McGahan Aug. 1983 29 p
(AF Proj. 2305)
(AD-A138028; AD-E750873; RADC-TR-83-181) Avail: NTIS HC A03/MF A01 CSCL 17/9

A new electromagnetic scattering facility located at Ipswich, Massachusetts is described. A 20 x 20 x 40 ft anechoic chamber was evaluated as to wall reflection coefficient at 10, 35, 98, and 140 GHz. The frequency stability of the measurement equipment was evaluated and was determined not to be a limiting factor in making radar cross section measurements. The backscatter radar cross sections of 24 metal spheres were measured at 10 GHz and compared with theory. The spheres ranged in size from 0.218 to 8.00 inches in diameter, corresponding to a Ka range of 0.581 to 21.293. The measured radar cross sections differed from theory by less than 0.6 dB. Radar cross sections as low as -46 dBsm were measured. The calibrated facility will be used to measure canonical shapes for both metallic and non-metallic targets. The non-metallic results will be used for the Cruise Missile Surveillance Program. Author (GRA)

**N84-21773#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PATTERN NULLING BY REFLECTOR SHAPING M.S. Thesis**
D. A. Havens Dec. 1983 110 p
(AD-A138049; AFIT/GE/EE/83D-26) Avail: NTIS HC A06/MF A01 CSCL 20/14

The applicability of adaptive array concepts to continuous aperture antennas was studied and appropriate aperture field distributions for pattern nulling were found from them. The adaptive array weights were found to be useful as discrete points in a continuous distribution. This distribution could then be used in an aperture integration scheme to produce a nulled pattern. Also studied was the use of geometrical optics to calculate the aperture field distribution of an arbitrarily shaped reflector. Under some restrictions, geometrical optics can provide a useful approximation. Constructing the aperture field of a reflector defined by a discrete grid of points using a numerical ray tracing scheme was also investigated. Certain numerical problems were identified. Finally, an attempt was made to implement the nulled pattern by a well known beam shaping method based on geometrical optics principles. This technique was found to be inadequate. More promising techniques for implementing the aperture distributions were suggested but not pursued in this work. Author (GRA)

**N84-21774#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**BURIED ANTENNA ANALYSIS AT VHF. PART 1: THE BURIED HORIZONTAL ELECTRIC DIPOLE M.S. Thesis**
J. W. Burks Jan. 1984 68 p
(AD-A138068; AFIT/GEO/EE/83D-1-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 09/5

A method was developed to find the far field radiation pattern of a buried horizontal electric dipole (HED) at 37.5 MHz. The imaginary part of the index of refraction was shown to be negligible for dry soil at this frequency so standard antenna theory and ray optic theory was used. The effect of the ground-air interface was modeled using the transmission coefficient and Snell's law for a dielectric interface. Because the current distribution for the buried HED depends on antenna construction, results are shown for the far field pattern in the air for different current distributions on the HED. The literature on this problem was reviewed; most used the Sommerfeld or moment methods to make the same calculations. The results of one of the reports using the Sommerfeld method could be compared and were found to be similar. An extensive bibliography is included. The analysis was then applied to a buried antenna array. The current distribution was known and was used to calculate the far field pattern. It was concluded that the far field pattern is highly dependent on the current distribution. This part is classified. GRA

**N84-21775#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**ACCURACY ESTIMATE FOR RADAR CROSS SECTION MEASUREMENTS OF TARGETS MODELLED BY MULTIPLE INDEPENDENT SCATTERERS IN CONSTANT CLUTTER M.S. Thesis**
J. N. Link Dec. 1983 141 p
(AD-A138075; AFIT/GE/EE/83D-39) Avail: NTIS HC A07/MF A01 CSCL 17/9

The error bounds for accuracy of radar cross section (RCS) measurements of targets in clutter are examined in detail. Traditional error bounds are based on precision at every individual aspect angle and on two deterministic sources (target and clutter). In this thesis a model is developed that describes the target and clutter probabilistically. The requirement of accuracy at every point is replaced by a requirement for accuracy of a running average of measured RCS values. The probability distribution of the ratio of the averaged, measured RCS to the averaged, true, free space target RCS is calculated. The standard deviation of this ratio represents how much the averaged, measured RCS data diverages from the averaged, true, free space target RCS. The results show that accuracy improves for increasing signal to clutter ratios, and also for increasing levels of averaging. Even averaging as few as eleven points, this new measure is shown to give more confidence in the measured, averaged results than the traditional approach. Author (GRA)

**N84-21776#** Naval Research Lab., Washington, D. C.
**MIRROR ANTENNA DUAL-BAND LIGHTWEIGHT MIRROR DESIGN Interim Report, Oct. 1979 - Jul. 1983**
D. D. Howard and D. C. Cross 12 Dec. 1983 26 p
(F12-131)
(AD-A138113; NRL-8765) Avail: NTIS HC A03/MF A01 CSCL 09/5

The design of a dual-band half-wave-plate mirror for a two-axis beam scan mirror antenna is described. The solution for design parameters is given for perfect 90 polarization rotation at a given aspect angle for each of the two bands. The process for optimizing the design for the full desired range of aspect is described. Practical fabrication considerations are discussed along with inclusion of capacitive susceptance of a protective covering in the design theory. Calculated performance is compared with measurements of mirror samples. GRA

**N84-21777#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PROTOCOL STANDARDS AND IMPLEMENTATION WITHIN THE DIGITAL ENGINEERING LABORATORY COMPUTER NETWORK (DELNET) USING THE UNIVERSAL NETWORK INTERFACE DEVICE (UNID). PART 2 M.S. Thesis**
P. W. Phister, Jr. Dec. 1983 330 p
(AD-A138119; AFIT/GE/EE/83D-58) Avail: NTIS HC A15/MF A01 CSCL 17/2

Development of the Air Force Institute of Technology's Digital Engineering Laboratory Network (DELNET) was continued with the development of an initial draft of a protocol standard for all seven layers as specified by the International Standards Organization's (ISO) Reference Model for Open Systems Interconnections. This effort centered on the restructuring of the Network Layer to perform Datagram routing and to conform to the developed protocol standards and actual software module development of the upper four protocol layers residing within the DELNET Monitor (Zilog MCZ 1/25 Computer System). Within the guidelines of the ISO Reference Model the Transport Layer was developed utilizing the Internet Header Format (IHF) combined with the Transport Control Protocol (TCP) to create a 128-byte Datagram. Also a limited Application Layer was created to pass the Gettysburg Address through the DELNET. This study formulated a first draft for the DELNET Protocol Standard and designed, implemented, and tested

the Network, Transport, and Application Layers to conform to these protocol standards. Author (GRA)

**N84-21778#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**DEVELOPMENT OF A COMMUNICATIONS FRONT END PROCESSOR (FEP) FOR THE VAX-11/780 USING AN LSI-11/23 M.S. Thesis**
Allan F. Masty Dec. 1983 286 p
(AD-A138152; AFIT/GCS/EE/83D-13) Avail: NTIS HC A13/MF A01 CSCL 17/2

A Communications Front-End Processor (FEP) was implemented for a Digital Equipment Corporation (DEC) VAX-11/780 using a DEC LSI-11/23 microcomputer. The LSI-11/23 serviced eight DEC VT-100 terminals and communicated with the VAX-11/780 over an Able Computer Technology, Inc. Direct Memory Access (DMA) interface. This investigation proceeded from a FEP design provided in a previous work and culminated in the Telecon 'C' compiler language coding of those design specifications. The design was translated into structure charts defining software module functions and interfaces. Program Design Language (PDL) was then used to outline the processing steps in a structured programming format for each software module. A data dictionary was constructed to document the data and functional module interfaces. The code was implemented in a 'top-down' manner. Author (GRA)

**N84-21779#** Mississippi Univ., University. Dept. of Electrical Engineering.
**AN EXPERIMENTAL STUDY OF CYLINDRICAL ANTENNAS RADIATING IN OR NEAR A LOSSY HALF SPACE Final Report, 15 Mar. 1982 - 20 Jun. 1983**
C. M. Butler and C. A. Harrison Dec. 1983 171 p
(Contract N66001-82-C-0045)
(AD-A138206; NOSC-CR-218) Avail: NTIS HC A08/MF A01 CSCL 09/1

Conducting structures residing near, within and partially within a lossy half space are investigated experimentally. The conducting structures are modeled by monopole antennas, and the lossy half space is modeled by the water within a non-metallic tank. Antenna aperture admittances are obtained using swept-frequency network analysis techniques with automated data collection and reduction. Results are compared to results of numerical analysis conducted as a related project. A sleeve monopole is oriented normal to the water surface with driving point near the bottom of the tank and source gap (aperture) in air. Gap height above the water surface, antenna radius and monopole length are varied. Electromagnetic properties of the water are varied by addition of NaCl. Coax-fed wire antennas are mounted perpendicular to a ground plane which is normal to and intersects the water surface. The antennas used are a straight-wire antenna in which the monopole is parallel to the water surface and a bent-wire antenna in which the wire is partially immersed in water. Height of the aperture above the water is varied. A coax-fed cylindrical monopole antenna is mounted perpendicular to a ground plane which is in contact with the water surface so that monopole and aperture are immersed in water. Author (GRA)

**N84-21780#** Aerospace Corp., El Segundo, Calif. School of Engineering.
**A MINIMUM RANGE CRITERION FOR RCS (RADAR CROSS-SECTION) MEASUREMENTS OF A TARGET DOMINATED BY POINT SCATTERERS M.S. Thesis**
B. M. Welsh Dec. 1983 130 p
(AD-A138230; AFIT/GE/EE/83D-71) Avail: NTIS HC A07/MF A01 CSCL 17/9

This thesis develops a minimum range criterion for radar cross-section measurements by neglecting the phase of the incident field at the target and considering only the amplitude distribution. In contrast to the traditional minimum range criterion, developed for a flat target characterized by specular reflection, the target examined in this thesis is characterized by a number of independent point scatterers located on the target surface. Instead of enforcing point by point accuracy, accuracy of the average target RCS is required, averaging over a number of measurements. The location of the point scatterers on the target are described probabilistically; the expected average measured RCS versus target range is calculated, and compared to results of a Monte-Carlo simulation. The traditional minimum range criterion is compared to the new minimum range criterion. The traditional minimum range criterion, based on phase uniformity across the target, requires minimum measurement ranges that are much larger than those ranges dictated by the new minimum range criterion for targets dominated by point scattering. Author (GRA)

**N84-21781#** Mission Research Corp., Santa Barbara, Calif.
**THE EFFECTS OF APERTURE ANTENNAS AFTER SIGNAL PROPAGATION THROUGH ANISOTROPIC IONIZED MEDIA**
D. L. Knepp 1 Mar. 1983 76 p
(Contract DNA001-81-C-0006; S99-QAXH)
(AD-A138286; AD-E301332; MRC-R-744; DNA-TR-81-254) Avail: NTIS HC A05/MF A01 CSCL 20/14

Because of the large ranges involved, a space based search and track radar requires a large aperture antenna to increase the energy collected and to create a narrow beam for accurate angle measurements and for resistance to localized jammers. This report gives the effects of such an antenna on measurements of received power, decorrelation time (or distance), mean time delay, time delay jitter and coherence bandwidth after propagation of the radar signal through a strongly disturbed transionospheric propagation channel. It is shown that aperture averaging can reduce observed signal power, increase observed decorrelation time and can be a significant factor in reducing the time delay jitter observed at the antenna output. As part of this analysis an analytic solution is obtained for the two-position, two-frequency mutual coherence function for spherical wave propagation in the strong scatter limit. Transmitter and receiver are located in free-space on opposite sides of a thick slab containing anisotropic electron density irregularities that are elongated in the direction parallel to the magnetic field. The orientation of the magnetic result is used to determine the effect of an antenna aperture as a function of geometry relative to the magnetic field. GRA

**N84-21782#** Nebraska Univ., Lincoln.
**SCATTERING AND DEPOLARIZATION OF ELECTROMAGNETIC WAVES-FULL WAVE SOLUTIONS Interim Report, 1 Mar. 1982 - 28 Feb. 1983**
E. Bahar Griffiss AFB, N.Y. RADC Nov. 1983 134 p
(Contract F19628-81-K-0025; AF Proj. 2305)
(AD-A138349; RADC-TR-83-118) Avail: NTIS HC A07/MF A01 CSCL 20/14

In the first Annual Technical Report (1 Mar. 1981 - 28 Feb. 1982) the principal elements of the full wave approach and its relationship to earlier solutions of scattering problems were summarized. For the convenience of the reader of this report, all the principal analytical results leading to full wave expressions for the normalized cross sections are presented in Section (1.1). Thus, starting with Maxwell's equations for the transverse components of the electromagnetic fields, the boundary conditions, the expressions for the complete field expansions and the associated orthogonal relations, the generalized telegraphists equations are derived. It is shown how these coupled equations are solved using a second order iterative approach and the judicious use of a local coordinate system that conforms with features of the rough surface. Explicit expressions for the scattered radiation fields and the like and cross polarized scattering cross sections are also presented. Thus the reader finds in this section a convenient review of all the background material that leads up to the general full wave expressions for the scattering cross sections. GRA

**N84-21783#** University Coll., London (England). Dept. of Electronic and Electrical Engineering.
**HIGH PRECISION PHASE SHIFTING TECHNIQUES Final Technical Report, 1 Nov. 1980 - 31 Oct. 1981**
J. R. Forrest Hanscom AFB, N.Y. RADC Nov. 1983 42 p
(Grant AF-AFOSR-0021-81; AF Proj. 2305)
(AD-A138397; RADC-TR-83-218) Avail: NTIS HC A03/MF A01

CSCL 17/9

The report describes techniques for the continuous monitoring and control of phase and output power in active phased array modules. The output phase and power of the signal from the module are sensed by a simple six-port network using Schottky barrier detectors; the output voltage from these detectors is used in a control loop to provide correction signals to a phase shifter and attenuator. Two control schemes have been compared. One is a digital loop using a microprocessor and this achieves an overall control accuracy of 0.1dB and 1 deg, but has the disadvantage of complexity and of a response time in the order of hundreds of milliseconds. The second is completely analogue loop which has a response time of less than 100ns and can provide real-time phase correction during the output pulse from a module. Although the control accuracy is marginally worse with the analogue loop in these initial tests, it is expected that refinements in the continuation of this work will enable the same accuracy to be achieved in both digital and analogue loop techniques. The application of these techniques may be particularly important in future monolithic integrated circuit radar module design.
Author (GRA)

**N84-21784#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**CLUTTER CANCELLATION TECHNIQUES FOR USE IN A SPACE-BASED RADAR SYSTEM M.S. Thesis**
J. DeVenuto Dec. 1983 228 p
(AD-A138467; AFIT/GE/EE/83D-18) Avail: NTIS HC A11/MF A01 CSCL 17/9

The ability of a space-based radar surveillance system to obtain target information from a clutter corrupted radar echo signal is dependent on the clutter cancellation technique employed. To thoroughly understand the nature of clutter so as to efficiently and effectively design and develop clutter cancellation techniques, fundamental mathematical relationships dealing with radar signal representation, probability theory, detection and estimation theory and signal comparison techniques were established and defined. Since the implementation of the mathematical expressions which describe clutter and clutter cancellation techniques are accomplished digitally, digital signal representation and digital filter characterization via FFt's were also established and defined. Drawing upon the established mathematical principles, as well as temporal probability models, spectral models and average backscatter coefficient models, clutter was described. Capitalizing on the different spectral characteristics between clutter and targets, three representative Doppler cancellation schemes were developed. The three schemes were delay line cancelers, Doppler filter banks and multiple look systems.
GRA

**N84-21785#** North Carolina Univ., Chapel Hill. Dept. of Statistics.
**ON THE STABILITY OF SIGNAL DETECTION**
A. F. Gualtierotti May 1983 29 p
(Contracts N00014-75-C-0491; N00014-81-K-0373; SRO-105)
(AD-A138525) Avail: NTIS HC A03/MF A01 CSCL 12/1

One of the basic problems in statistical communication theory is that of detecting, at the end of a communication channel, a signal imbedded in noise. The Gaussian model is a model for which the noise as well as the received signal are Gaussian processes with equivalent laws, so that the resulting detection problem is nonsingular. Unfortunately most solutions to problems involving signals in Gaussian noise are based on a knowledge of the auto-correction function or spectrum (if the noise is stationary). This document studies the probabilities of false alarm and false dismissal for sure signals embedded in additive noise. The noise is contaminated Gaussian, and the framework is such that continuous-time problems can be studied.
GRA

**N84-21786#** California Univ., Livermore. Lawrence Livermore Lab.
**MODELING ANTENNAS NEAR TO AND PENETRATING A LOSSY INTERFACE**
G. J. Burke and E. K. Miller 22 Sep. 1983 46 p refs Presented at the NATO-AGARD Lecture Series Number 131, Ankarra (Turkey), 19-28 Oct. 1983 Sponsored in part by the U.S. Army
(Contract W-7405-eng-48)
(DE84-004785; UCRL-89838; CONF-8310167-3) Avail: NTIS HC A03/MF A01

A technique for modeling wire objects interacting across or penetrating the planar interface which separates two half space is described. The moment-method treatment is employed, based on the thin wire approximation to the electric-field integral equation, with the effect of the interface included via the usual Sommerfeld integrals. The computation time associated with evaluating the latter is substantially shortened by using an interpolation based technique plus asymptotic field expressions. Although developed specifically for the wire problem, the procedure is also applicable, with slight modification, to modeling surface objects as well. Special account is taken of the charge discontinuity that occurs at the point a wire penetrates the interface. Example calculations are shown for the antenna-ground stake problem; monopole antenna driven against a simple ground screen; the fields of buried objects; and a simple EMP simulator.
DOE

**N84-21787#** National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
**CRYPTOGRAPHY IN A COMMUNICATION SYSTEM In DUTCH; ENGLISH summary**
M. R. Best 10 Oct. 1982 28 p refs Presented at Course on Cryptography, Amsterdam, 4-8 Oct. 1982
(NLR-MP-82051-U) Avail: NTIS HC A03/MF A01

Communication system protection by cryptography is reviewed. Privacy and authentication problems are discussed. Conventional cryptographic systems as well as public key systems are complementary. Classical security methods such as signed contracts, physical locks, passwords and keys remain important.
Author (ESA)

**N84-21788#** National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
**SHANNON: THEORY AND CRYPTOGRAPHY [SHANNON: THEORIE EN CRYPTOGRAFIE]**
H. F. A. Roefs 17 Nov. 1982 22 p refs In DUTCH; ENGLISH summary Presented at Course on Cryptography, Amsterdam, 4-8 Oct. 1982
(NLR-MP-82053-U) Avail: NTIS HC A02/MF A01

The ideas of Shannon as a theoretical basis for cryptography are discussed. The notion of mutual information is introduced to provide a deeper understanding of the functioning of cryptographic systems. Shannon's absolute secure cryptosystem and his notion of unicity distance are explained.
Author (ESA)

**N84-21789#** Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Fernmeldetechnisches Zentralamt.
**OPTIMAL DESIGN OF AN ANTENNA ARRAY**
K.-D. Wolfenstetter Sep. 1983 22 p refs
(FTZ-454-TBr-38-E) Avail: NTIS HC A02/MF A01

A mathematical model of nonsmooth optimization is used to design an antenna array such that the sidelobes are minimized. The design is formulated as nondifferentiable minimization problems (minimum and minimax problem). Numerical results prove the efficiency of the method.
Author (ESA)

**N84-21790#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group 3: Telecommunications.
**INVESTIGATION INTO A DIGITAL MODULATION METHOD FOR A FREQUENCY HOPPING SYSTEM, USING A LOW BIT RATE**
B. J. A. Koenderink Nov. 1983 40 p refs In DUTCH; ENGLISH summary
(Contract A79/KL/152)
(PhL-1983-44; TDCK-78686) Avail: NTIS HC A03/MF A01

A digital modulation method for a frequency hopping system was investigated. A relation exists between the bit rate and the spectral bandwidth of the modulated signal. This relation is investigated for various modulation methods (digital frequency

modulation and correlative phase modulation methods). Minimum shift keying yields the smallest bandwidth. Author (ESA)

**N84-21791#** Elettronica San Georgio-ELSAG S.p.A., Genoa (Italy).
**TECHNICAL ADDENDUM TO THE STUDY: ERS-1 MISSION, FUCINO STATION. SAR PROCESSOR BASED UPON EMMA ARCHITECTURE**
Paris ESA Jul. 1983 57 p 2 Vol.
(Contract ESA-5130/83/HGE-I(SC))
(ERI-171; ESA-CR(P)-1831-Vol-1) Avail: NTIS HC A04/MF A01

A SAR data processing configuration compatible with ERS-1 (ESA) specifications, which processes a SAR image in 12 min or less is proposed. It is a modular, extendable system, based on the EMMA/2 pattern recognition design. The configuration uses a single-region EMMA/2 multiprocessor, consisting of 2 families, and a VAX-11/750 as host computer. The VAX controls the standard peripheral devices and performs the supervisor tasks. Author (ESA)

**N84-21792#** Telespazio, S.p.A., Rome (Italy).
**ERS-1 MISSION: FUCINO STATION**
Paris ESA 15 Sep. 1983 183 p 2 Vol.
(Contract ESA-5130/83/HGE-I(SC))
(ESA-CR(P)-1831-Vol-2) Avail: NTIS HC A09/MF A01

The adaptability of existing facilities at the Earthnet Station of Fucino for real time data acquisition, recording and associated data processing for the ERS-1 (ESA) mission was investigated. An acquisition and processing chain dedicated only to ERS-1, and multimission solution for management of LANDSAT and ERS-1 data were considered. The baseline configuration allows acquisition, recording and processing of SAR regional data. The preferred option extends the baseline configuration to allow acquisition, recording and quasi real time processing (less than 3hr from acquisition to dissemination) of direct readout low bit rate data. System requirements, interfaces, equipment, operations, and maintenance are discussed. Author (ESA)

**N84-21793#** Gardner Research Co., Palo Alto, Calif.
**MULTIPATH LINK AND MODEM DESIGN FOR SATELLITE MOBILE COMMUNICATIONS**
Floyd M. Gardner Paris ESA 31 Aug. 1983 471 p refs
(Contract ESTEC-5146/82/NL-GH(SC))
(ESA-CR(P)-1833) Avail: NTIS HC A20/MF A01

Modems for digital L-band communication between satellites and aircraft, ships, and land vehicles are discussed. Low-rate, low-cost communications for small users is desired, so antennas are nonsteerable. Received signal-to-noise ratios are small so power conservation is critically important. Reflections from the Earth's surface have significant amplitude and cause multipath interference to the desired signal. Data rates of 100, 1200, and 4800 bps were considered. Modulation types examined include BPSK/DPSK, FSK, and GMSK. Digital implementation of the modems is proposed wherever feasible. Author (ESA)

**N84-21794#** TICRA ApS, Copenhagen (Denmark).
**EXPERIMENTAL SPHERICAL NEAR FIELD ANTENNA TEST FACILITY, PHASE 3. VOLUME 2: STUDY OF AN OFFSET REFLECTOR ANTENNA WITH A SAGGING FEED SUPPORT Final Report**
Aksel Frandsen Paris ESA Jun. 1983 63 p refs
(Contract ESTEC-4682/81/NL-MS)
(S-179-01-Vol-2; ESA-CR(P)-1834-Vol-2) Avail: NTIS HC A04/MF A01

A numerical model for satellite antenna simulations based on calculating the near field from the antenna by geometrical diffraction theory and then transforming to the far field was developed. For an offset reflector with a circular aperture and a nonrigid feed support, it is demonstrated that the impact of the sagging feed depends on antenna mount and orientation with respect to the measurement grid. Predicted far field pattern cuts show pattern degradations for different degrees of feed rigidity. The influence of reflector edge taper is also shown. Simulations for an idealized model antenna show that stiffening of the feed support considerably improves pattern prediction. Author (ESA)

**N84-21795#** Thomson-CSF, Paris (France).
**STUDY OF A SATELLITE COMMUNICATION SYSTEM FOR WIDEBAND COMMUNICATIONS: EXECUTIVE SUMMARY Final Report**
Paris ESA Aug. 1983 155 p
(Contract ESTEC-4931/81/NL-GM(SC))
(ESA-CR(P)-1839) Avail: NTIS HC A08/MF A01

Configurations of a 20/30 GHz satellite system providing wide band services over Europe in the 1990's were studied to identify payload technologies which have to be developed. A market study assessed potential demand for wide band services in Europe and determined the competitivity or complementarity of a space communication system with optical fiber systems. Results show that a wide band satellite system is especially of interest if there is a high growth in demand for video teleconferences. Due to the large transmission capacities required (1000 channels) it is mandatory to develop architectures and technologies in order to reduce the space segment cost and make it competitive with optical fiber transmissions. Satellite systems would be vulnerable in a price war. Author (ESA)

**N84-21796#** ANT Nachrichtentechnik, Backnang (West Germany). Space Communications Systems Div.
**PERFORMANCE ASSESSMENT OF SERIAL MINIMUM SHIFT KEYING (SMSK) MODULATION TECHNIQUE. VOLUME 1: EXECUTIVE SUMMARY**
S. Rasmussen and W. Schreitmueller Paris ESA Sep. 1983 42 p refs 2 Vol.
(Contract ESTEC-5157/82/NL-GM(SC))
(ESA-CR(P)-1840-Vol-1) Avail: NTIS HC A03/MF A01

The results of a performance analysis of serial minimum shift keying (SMSK) are summarized. Implementation of SMSK modems and partial response continuous phase modulation (CPM) signal detection with an SMSK receiver are discussed. M.G.

**N84-21797#** ANT Nachrichtentechnik, Backnang (West Germany). Space Communications Systems Div.
**PERFORMANCE ASSESSMENT OF SERIAL MINIMUM SHIFT KEYING (SMSK) MODULATION TECHNIQUE, VOLUME 2 Final Report**
S. Rasmussen and W. Schreitmueller Paris ESA Sep. 1983 170 p refs 2 Vol.
(Contract ESTEC-5157/82/NL-GM(SC))
(ESA-CR(P)-1840-Vol-2) Avail: NTIS HC A08/MF A01

Performance and hardware complexity of serial minimum shift keying (SMSK) and QPSK for satellite onboard data processing were compared. For modulation shift keying (MSK) SMSK is not as bandwidth efficient as QPSK. The SMSK-modem designs proposed by MOTOROLA are adaquate for broadband transmission. For narrowband transmission in a second step, RF-bandlimiting is applied. Motorola recovery circuits acquisition performance is doubtful. For partial response continuous phase modulation with 3RC pulses, signals can be detected with an ordinary SMSK-receiver and higher bandwidth efficiency is possible. Author (ESA)

**N84-21798#** Science Research Council, Chilton (England).
**THE USE OF DUAL-POLARIZATION RADAR DATA TO PREDICT ATTENUATION FROM PRECIPITATION ON EARTH-SPACE PATHS Final Report**
S. M. Cherry and J. W. F. Goddard Paris ESA Oct. 1983 206 p refs
(Contract ESTEC-4537/80/NL-MS(SC))
(ESA-CR(P)-1845) Avail: NTIS HC A10/MF A01

The effect of precipitation on microwave communications between Earth stations and satellites was estimated by predicting the excess attenuation due to the precipitation, from radar data. Site diversity performance was investigated as a function of frequency (11, 14 and 20 GHz), elevation angle and site separation. The use of differential reflectivity measurements to improve

attenuation predictions was tested. The dual polarization technique gives good attenuation predictions at 11 GHz. At 14 and 20 GHz, cloud attenuations are significant, but do not affect radar predictions of precipitation attenuation. Elevation dependence in the CCIR model works well for the time percentages 0.01% and 0.1%.
Author (ESA)

**N84-21799#** Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).
**CONTRIBUTION TO THE QUESTION BIT ERROR PERFORMANCE OF CCITT STUDY GROUP 18**
Ralf Herzer Dec. 1983 45 p refs In GERMAN; ENGLISH summary
(FI-44-TBr-92) Avail: NTIS HC A03/MF A01

Bit error burst performance of digital information communication channels at a rate of 2.048 kbit/s is discussed in the light of computer-aided evaluations of bit error structures recorded for these channels. Channel modelling quality was assessed by Neyman's contagious type-A probability distribution. Results were compared to those obtained in similar investigations. A satisfactory agreement is stated. Results show a possibility of achieving better approximations by means of type B or C distributions or generalized contagious probability distributions according to Beall.
Author (ESA)

**N84-21800#** Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
**MULTIPATH PROPAGATION AT 11, 18, AND 36 GHz DUE TO DUCTING**
Sture Wickerts Oct. 1983 23 p ref
(FOA-C-20511-E2; ISSN-0347-3694) Avail: NTIS HC A02/MF A01

Field strengths at 11, 18, and 36 GHz were measured at a 15 km and a 5 km radio link over land. At the transmitter site the stratification of the atmosphere was monitored with a sodar. Temperature inversions are detected in the layer from the ground to 600 m. Almost all duct layers are connected with temperature inversions. Statistics of layers in the layer close to ground and of multipath propagation are presented. Case studies show that the appearance of multipath propagation is observed with time delay between the frequencies 11, 18, and 36 GHz but not always in the same order. Refraction is caused by the vertical gradient of refractive index. Fading is set up by variations of that gradient and not by the changing heights of the duct layers. Author (ESA)

**N84-21801#** Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
**RAIN ATTENUATION AT 11, 18, AND 36 GHz**
Sture Wickerts Oct. 1983 12 p refs
(FOA-C-20512-E2; ISSN-0347-3694) Avail: NTIS HC A02/MF A01

Atmospheric attenuation and path average rainfall rate were compared along a 15 km radio link operating at 11, 18, and 36 GHz. The relationship A = k1 R sup k2, where A = attenuation (dB/km), R = rainfall rate (mm/hr), and k1, k2 = constants was studied. Rain showers were grouped to find the values of k1 and k2 in four types of rain. The values differ between the four classes, and are smaller than those found in the literature and those recommended by CCIR, possibly because literature values are for mean attenuation and mean rainfall rate over a longer period of time.
Author (ESA)

**N84-21802#** National Telecommunications and Information Administration, Washington, D.C.
**AIR-TO-GROUND HF (HIGH FREQUENCY) PROPAGATION PREDICTION MODEL FOR FAST MULTICIRCUIT COMPUTATION**
F. G. Stewart, L. A. Berry, and V. Agy Aug. 1983 66 p refs
(PB84-145961; NTIA/Rept-83-131) Avail: NTIS HC A04/MF A01 CSCL 17B

A radio propagation prediction computer code was developed to permit rapid simulation of high frequency (HF) air-to-ground telecommunication circuits. This prediction program provides estimates of both skywave and groundwave HF propagation parameters. The skywave and groundwave propagation parameters can be obtained for radio circuits with transmitters and receivers on the surface of the earth or with one or both ends of the circuit elevated up to 50 km. When a large number of circuits in a given area are simulated for a single time, the program is an order of magnitude faster than its predecessors. A description of the air-to-ground HF propagation prediction program as well as illustrations of the results obtained from the program is provided.
GRA

**N84-21580#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT OF VENERA-15, -16 RADARS**
V. Gubarev *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 49-51 Transl. into ENGLISH from Pravda (Moscow), 21 Oct. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

**N84-21660#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF ANISOTROPY AND VISCOSITY ON PROPAGATION ON WAVES IN MULTILAYER CYLINDERS Abstract Only**
Sh. U. Galiyev, V. A. Romaschenko, and Z. G. Alpaidze *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 44 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 40-44 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21941*#** Kansas Univ., Lawrence. Center for Research.
**DETERMINATION OF THE SOURCES OF RADAR SCATTERING Abstract Only**
R. K. Moore and R. Zoughi *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 41 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 17I

**N84-21942*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**EFFECTS OF VEGETATION CANOPY STRUCTURE ON MICROWAVE SCATTERING Abstract Only**
Jack F. Paris *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 42 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20N

**N84-22416*#** California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
**REAL-TIME SYNTHETIC APERTURE RADAR PROCESSING**
Demetri Psaltis, Michael Haney, and Kelvin Wagner *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 199-213 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 17I

# 33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

**N84-21803*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**A TWT AMPLIFIER WITH A LINEAR POWER TRANSFER CHARACTERISTIC AND IMPROVED EFFICIENCY**
Henry G. Kosmahl and John C. Peterson (Hughes Aircraft Co., Torrance, Calif.) 1984 12 p refs Proposed for presentation at the 10th Commun. Satellite Systems Conf., Orlando, Fla.,

18-22 Mar. 1984; sponsored by AIAA
(NASA-TM-83590; E-1793; NAS 1.15:83590) Avail: NTIS HC A02/MF A01 CSCL 09A

A novel method called 'Dynamic Velocity Taper' to linearize the Pout versus Pin transfer characteristic that does not require any extraneous circuitry or tuning, has large bandwidth capabilities (> 10 percent) and offers also an increase in the intrinsic traveling wave tube (TWT) efficiency by 1 to 2 dB is described. In addition, the method permits the TWT to be operated at or near the synchronous voltage (b plus or minus o) which produces a flat small and large signal gain responses and low AM to PM conversion. The physics of the method and experimental verification are given. The implementation should have a significant impact on TWT performance and increase the channel capacity of communication satellites. R.J.F.

**N84-21804#** Ohio State Univ., Columbus. Electroscience Lab.
**MICROSTRIP ANALYSIS TECHNIQUES Final Report, 1 Nov. 1980 - 31 Oct. 1983**
E. H. Newman 31 Oct. 1983 7 p
(Contract DAAG29-81-K-0020)
(AD-A137972; ESL-713402-7; ARO-17446.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report will describe three computational techniques applicable to microstrip antennas and arrays. The first is an analysis of the self and mutual impedance between microstrip antennas on a flat grounded dielectric slab. The second is an analysis of a microstrip array plus it's microstrip transmission line feed network. The third is an analysis of the self and mutual impedance between microstrip antennas on a dielectric coated cylinder. Author (GRA)

**N84-21805#** Mississippi Univ., University. Dept. of Electrical Engineering.
**AN ANALYSIS OF THE COAX-FED MONOPOLE IN A GENERAL MEDIUM Final Report, 15 Mar. 1982 - 20 Jun. 1983**
C. M. Butler, K. A. Michalski, and S. Filipovic 25 Dec. 1983 46 p
(Contract N66001-82-C-0045)
(AD-A137981; NOSC-CR-220) Avail: NTIS HC A03/MF A01 CSCL 09/1

A coax-fed monopole antenna in a general linear medium is investigated theoretically and results are corroborated experimentally. The monopole resides in a general lossy medium above a ground plane and is formed by the extension of the center conductor of a coaxial waveguide whose outer conductor terminates in the ground plane. The excitation is the usual TEM field in a coax. The analysis is sufficiently general to accommodate a bead of prescribed dielectric properties to support and center the coax inner conductor. Coupled integral equations are derived for the monopole current and for the electric field in the annular aperture formed where the coaxial guide joins the ground plane. These equations account for the higher order modes in the coaxial guide. A numerical/analytical method for solving these coupled equations is developed and implemented. Numerical results--monopole current, aperture electric field, and driving point admittance-are obtained and are compared with available experimental data. The agreement is generally excellent. Author (GRA)

**N84-21806#** Centre National de la Recherche Scientifique, Besancon (France).
**LOW TEMPERATURE QUARTZ CRYSTAL OSCILLATOR FAST WARM-UP SAW OSCILLATOR Final Technical Report, 1 Jun. 1981 - 31 May 1982**
J. J. Gagnepain and D. Hauden Nov. 1983 39 p
(Grant AF-81-0191; AF Proj. 2305)
(AD-A138024; RADC-TR-83-242) Avail: NTIS HC A03/MF A01 CSCL 09/5

The objectives of this program are to: evaluate the frequency instabilities of quartz crystal resonators as a function of temperature and Q-factors, show the feasibility of low temperature quartz oscillators, and determine the dynamic thermal behavior of SAW quartz oscillators and the precise crystal orientation and wave propagation direction with minimized sensitivities. The contribution of impurities to finite Q-factor of quartz resonator at low temperature is studied, both theoretically and experimentally. Short and long term frequency stability measurements are performed at low temperature with a dual crystal passive system adapted to liquid helium. Simultaneously temperature in the bath is controlled and correlation between frequency and temperature fluctuations is studied. Dynamic temperature sensitivity of SAW oscillators is calculated by using a one dimensional thermal model. Crystal cut orientation and wave propagation direction are exploded, at zero first order static temperature coefficient, in search of minimized dynamic thermal sensitivities. GRA

**N84-21807#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**A MICROSTRIP TIME DELAY CIRCUIT ON BARIUM TETRATITANATE M.S. Thesis**
D. A. Hahn Dec. 1983 100 p
(AD-A138026; AD-E750873; AFIT/GE/EE/83D-25) Avail: NTIS HC A05/MF A01 CSCL 09/5

A microstrip time delay circuit, variable from 1/2 to 8 nsec in 1/2 nsec increments at a 3 GHz operation frequency with a 10% bandwidth is presented. The temperature stable, miniature circuit is designed for a 50 x 50 x 2 mm substrate of barium tetratitanate, BaTi409. A PIN diode switching control circuit was fabricated for user selection of the delay time provided by the four-bit loaded switched-line circuit. PIN diodes, chip capacitors, and wound inductors were characterized for this S-Band frequency range. Several different methods and attempts to adhere a conductor to the barium tetratitanate substrate were made and are presented here, however, the complete time delay circuit was never fabricated. Author (GRA)

**N84-21808#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**EXPERIMENTAL INVESTIGATION OF SWITCHED-CAPACITOR CIRCUITS AND SYSTEMS M.S. Thesis**
D. Satirtav Dec. 1983 84 p
(AD-A138034; AFIT/GE/EE/83D-60) Avail: NTIS HC A05/MF A01 CSCL 09/5

In the literature, there are many technical papers describing the theoretical characteristics, advantages of switched-capacitor circuits and systems. The experimental research presented here is an investigation of the characteristics of specific switched-capacitor circuits as described by some of these technical papers. The circuits investigated include a second order band elimination filter, a simulation of inductor and a AM demodulator. For each circuit, the performance of the switched-capacitor implementation was compared to the theoretical analysis. In addition, for the band elimination filter and inductor circuits, the performance of the switched-capacitor circuit was compared to an equivalent implementation using normal analog components. Analytical results were duplicated using switched-capacitor circuits. The clock frequency was a critical parameter for the experiment. Author (GRA)

**N84-21809#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**SERIES DETONATOR INITIATION SYSTEM M.S. Thesis**
K. Olmscheid Dec. 1983 71 p
(AD-A138101; AFIT/GEO/EE/83D-6) Avail: NTIS HC A04/MF A01 CSCL 19/1

The purpose of this thesis was to design, build, and test a high voltage detonator initiation system capable of firing a series modular detonator array. This initiation system was designed to optimally fire a detonator array of 25 detonators, but is capable of firing detonator arrays of different lengths. The procedures used to develop this initiation system included four steps. First, the minimum burst current and the maximum current frequency required for successful detonator initiation were determined. Second, the equivalent circuits of the detonator array/return conductor combination and connector cable were derived. Third, the design of the initiation system was made. Fourth, the initiation system was built and tested. The testing of the initiation system using array sizes of 3 and 25 detonator models was limited. These tests showed

that the firing switch had an average delay time of 733 and 725 nsec respectively for the small and large arrays. GRA

**N84-21810*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PRODUCT ASSURANCE TECHNOLOGY FOR PROCURING RELIABLE, CUSTOM LSI/VLSI ELECTRONICS Progress Report, May 1981 - Oct. 1982**
M. G. Buehler, T. W. Griswold, C. A. Pina, B. R. Blaes, and C. C. Timoc Sep. 1983 155 p
(Contract NAS7-918; ARPA Order 4665)
(NASA-CR-173405; NAS 1.26:173405; AD-A138213;
JPL-PUB-83-70) Avail: NTIS HC A08/MF A01 CSCL 09E

The effort described in this report initiates the development of a product assurance methodology that is intended to be used in the process of qualifying reliable, custom, CMOS-bulk integrated circuits obtained from silicon foundries using a set of composite layout rules. A major element in this methodology is the microelectronic test chip that is fabricated along with the integrated circuits. This report describes the effort involved in further developing the test-chip methodology. The major accomplishments include the development of a state-of-the-art parametric tester; the development of CMOS-bulk layout rules; the development of bulk test strips and test chips; the development of certain test structures, including the pinhole array capacitor for yield analysis and the split-cross-bridge resistor for process characterization; the development of a test-chip assembler software tool; the evaluation of two CMOS-bulk silicon foundry runs; and the identification of critical elements in procuring custom circuits from silicon foundries.
Author (GRA)

**N84-21811#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**AN AUTOMATIC SINE-WAVE GRATING CONTROLLER TO BE USED FOR CONTRAST SENSITIVITY TESTING M.S. Thesis**
M. H. Swann 5 Dec. 1983 144 p
(AD-A138294; AFIT/GE/EE/83D-65) Avail: NTIS HC A07/MF A01 CSCL 09/1

This report documents the additional design, construction, and testing of the brightness and contrast controller system which includes an embedded microcomputer. It is planned that researchers will use this controller to maintain prescribed video output of laboratory video monitors during vision research. The controller requires a video signal consisting of a sine-wave grating. A 512-element photodiode array directly measures the monitor's screen to produce an analog signal which is then digitized and stored in the computer. These data are used to compute the actual brightness and contrast of the monitor. In an attempt to complete the controller's system requirements, the controller prototype hardware was completed and partially packaged. Closed-loop system testing was performed for both the brightness and contrast control circuitry. Brightness and contrast control circuitry, a vertical synch pulse generator, a user-interface console, and power supply with additional voltage-regulator circuitry were designed and added to the existing prototype. GRA

**N84-21812#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**SINGLE CIRCUIT BOARD IMPLEMENTATION OF A DIGITALLY COMPENSATED SAW OSCILLATOR (DCSO) M.S. Thesis**
J. W. McGuire Dec. 1983 128 p
(AD-A138313; AFIT/GE/EE/83D-44) Avail: NTIS HC A07/MF A01 CSCL 09/5

A circuit, using standard off-the-shelf components, for digital temperature compensation of a SAW oscillator was designed. This circuit was implemented on a single circuit board. A crucial component of the circuit, the AFIT IC, designed by four previous AFIT students and fabricated by NCR, failed to operate at a required frequency of 37 MHz. This caused an early halt to the project; however, several parts of the design were tested individually with good results. The portion of the circuit consisting of the D/A converter, op amp, and phase shifter was tested. For various addresses programmed on the D/A converter inputs, which simulated the output from the two EPROMs, a total phase shift of 107 degrees was obtained from the phase shift circuit. The thermometer and clock paths of the SAW device were made to oscillate at their respective resonant frequencies by introducing the proper amounts of phase shift and attenuation into the feedback loops. The thermometer and clock resonant frequencies were 309 MHz and 298 MHz respectively. GRA

**N84-21813#** California Univ., Berkeley. Electronics Research Lab.
**VLSI RESEARCH, SEMI-ANNUAL TECHNICAL R&D (RESEARCH AND DEVELOPMENT) Status Report, Apr. - Oct. 1983**
R. W. Brodersen Oct. 1983 24 p
(Contract N00039-80-C-0107; ARPA Order 4031)
(AD-A138339) Avail: NTIS HC A02/MF A01 CSCL 09/5

In our architecture research a 41,000 transistor second generation 32 bit processor, which demonstrates the advantages of the reduced instruction set concept, has been successfully fabricated and tested. In addition a 46,000 transistor instruction cache was also found to be fully operational and it incorporated a new redundancy idea that tripled the yield. A new cad tool, a timing verifier called Crystal, was found to be extremely useful as it detected potential performance mistakes during the design process. In the computer aids for design and layout research, 85 copies of the new tools tape have been distributed to university and industrial labs in the U.S. This tape contains about 25 programs, including several new programs (Lyra, Crystal, Peg and Tpack). A new improved version of the Waveform-Relaxation based simulator has been developed which utilizes new techniques to speed up convergence and for error control. A new algorithm called BLOSSOM has been developed, which can exploit the parallelism of VLSI for the solution of large-scale linear systems of algebraic equations. GRA

**N84-21814#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**REPETITIVE SWITCHING FOR AN ELECTROMAGNETIC RAIL GUN M.S. Thesis**
J. M. Gruden Dec. 1983 90 p
(AD-A138360; AFIT/GE/EE/83D-22) Avail: NTIS HC A05/MF A01 CSCL 09/1

Previous testing on a repetitive opening switch for inductive energy storage has proved the feasibility of the rotary switch concept. The concept consists of a rotating copper disk (rotor) with a pie-shaped insulator section and brushes which slide along each of the rotor surfaces. While on top of the copper surface, the brushes and rotor conduct current allowing the energy storage inductor to charge. When the brushes slide onto the insulator section, the current cannot pass through the rotor and is diverted into the load. This study investigates two new brush designs and a rotor modification designed to improve the current commutating capabilities of the switch. One brush design (fringe fiber) employs carbon fibers on the leading and trailing edge of the brush to increase the resistive commutating action as the switch opens and closes. The other brush design uses fingers to conduct current to the rotor surface, effectively increasing the number of brush contact points. The rotor modification was the placement of tungsten inserts at the copper-insulator interfaces. GRA

**N84-21815#** North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Electrical Engineering.
**MILLIMETER WAVE METAL-INSULATOR-METAL DETECTOR/MIXER DIODE Final Technical Report, May 1981 - Jul. 1983**
C. Yu Dec. 1983 51 p
(Contract F33615-81-K-1418; AF Proj. 2002)
(AD-A138391; AFWAL-TR-83-1179) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes the fabrication of metal-insulator-metal (MIM) structures for use as broadband detectors and mixers in the microwave and mm region. Two types of structures have been fabricated: a point contact diode based on a tungsten whisker in contact with a nickel post through its natural oxide layer (MOM), and a planar diode fabricated by deposition of

discontinuous metal films on a glass substrate. Primary efforts were directed at overcoming the known instability of the point contact diode and improving the low responsivity of the planar film diode. The final MOM point contact diode acquired a controlled hooked whisker tip that demonstrated sufficient cushioning action against ambient vibrations and provided a free and end pointing slightly away from the junction area, thus introducing minimum degradation to diode performance. This enabled the diode to better accommodate thermal expansion under high power radiation with little degradation of performance. The nickel coated quartz post resolved the problem of significant variations in the metal-metal spacing due to ambient temperature fluctuations. Such a diode has shown stable X band detected output with less than 10% signal level fluctuations over three weeks under room temperature fluctuations form 50 F to 95 F and normal room vibrations. GRA

**N84-21816#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**PRINTED CIRCUIT BOARD LAYOUT BY MICROCOMPUTER M.S. Thesis**

E. W. Krausman Dec. 1983 275 p
(AD-A138427; AFIT/GE/EE/83D-35) Avail: NTIS HC A12/MF A01 CSCL 09/5

Printed circuit board artwork is usually prepared manually because of the unavailability of computer-aided-design tools. This thesis presents the design of a microcomputer based printed circuit board layout system that is easy to use and cheap. Automatic routing and component placement routines will significantly speed up the process. The design satisfies the following requirements: Microcomputer implementation, portable, algorithm independent, interactive, and user friendly. When it is fully implemented a user will be able to select components and a board outline from an automated catalog, enter a schematic diagram, position the components on the board, and completely route the board from a single graphics terminal. Currently, the user interface and the outer level command processor have been implemented in Pascal. Future versions will be written in C for better portability. GRA

**N84-21817#** General Electric Co., Schenectady, N. Y. Electric Utility Systems Engineering Dept.

**METHOD FOR DETERMINING HOW TO OPERATE AND CONTROL WIND TURBINE ARRAYS IN UTILITY SYSTEMS**

S. H. Javid, R. L. Hauth, T. D. Younkins, T. W. Roddoch (ORNL), and P. R. Barnes (ORNL) Jan. 1984 8 p refs Presented at the IEEE Poser Eng. Soc. Winter Meeting, Dallas, 29 Jan. 1984
(Contract W-7405-eng-26)
(DE84-005817; CONF-840112-2) Avail: NTIS HC A02/MF A01

A method for determining how utility wind turbine arrays should be controlled and operated on the load frequency control time-scale is presented. Initial considerations for setting wind turbine control requirements are followed by a description of open loop operation and of closed loop and feed forward wind turbine array control concepts. The impact of variations in array output on meeting minimum criteria are developed. The method for determining the required control functions is then presented and results are tabulated. DOE

**N84-21818#** Sandia Labs., Albuquerque, N. Mex.

**COMPATIBILITY AND ACCELERATED AGING STUDY FOR Li(Si)/FeS/SUB 2 THERMALLY ACTIVATED BATTERIES**

Judith W. Mead, Jimmie Q. Searcy, Patricia N. Neiswander, and Robert L. Poole (GE) Dec. 1983 70 p refs
(Contract DE-AC04-76DP-00789)
(DE84-006099; SAND-83-1081) Avail: NTIS HC A04/MF A01

Thermally activated batteries using the lithium (silicon) iron disulfide (Li(Si)/FeS2) electrochemical system are used in weapons having a required storage life of 25 years and high reliability. A review of known data revealed no information on the compatibility of Li(Si)/FeS2 with the organic materials used in the system. The compatibility question is studied. Accelerated-aging data on pairs of materials were produced. In addition, a group of production batteries was aged and tested. Three aging temperatures were used during the one-year study. Gas analyses, electrical tests and mechanical tests were compared for control and aged samples. Two results, the depletion of oxygen and an increase in hydrogen in the compatibility and accelerated-aging samples, stimulated additional studies. No unexpected or significant changes were observed in the electrical or mechanical properties of the organic materials. Calorific output and chloride ion content of heat pellets indicated no degradation with aging. Ignition sensitivity and burn rate measurements suggested no heat pellet degradation. Oxygen content in aged lithium (silicon) anodes remained within acceptable limits. Single-cell tests and battery test results showed no degradation with aging. DOE

**N84-21819#** Varian Associates, Palo Alto, Calif.

**THE 100 GHz, 1 MW, CW GYROTRON STUDY PROGRAM Final Report**

K. Felch, R. Bier, M. Caplan, and H. Jory Sep. 1983 74 p refs
(Contract W-7405-eng-26)
(DE84-005751; ORNL/Sub-79-21453/S2) Avail: NTIS HC A04/MF A01

The feasibility of various approaches in designing a 100 GHz, one Mega Watt (MW) Carrier Wave (CW) gyrotron are presented. A summary is given of the possible configurations for a high average power, high frequency gyrotron, including a historical survey of experimental results which are relevant to the various approaches. A set of basic scaling considerations which enable qualitative comparisons between particular gyrotron interaction circuits is presented. These calculations are important in understanding the role of various electron beam and circuit parameters in achieving a viable gyrotron design. Following these scaling exercises, a series of design calculations is presented for a possible approach in achieving 100 GHz, one MW CW. These calculations include analyses of the electron gun and interaction circuit parts of the gyrotron, and a general analysis of other aspects of a high average power, high frequency gyrotron. Scalability of important aspects of the design to other frequencies is also discussed, as well as key technology issues. DOE

**N84-21820#** California Univ., Livermore. Lawrence Livermore Lab.

**PRELIMINARY EXPERIMENTS WITH A CARBON FIBER TUFT CATHODE**

Thomas J. Fessenden 11 Jan. 1984 13 p refs
(Contracts W-7405-eng-48; N60921-83-WR-W0113; ARPA Order 4395)
(DE84-006296; UCID-19990) Avail: NTIS HC A02/MF A01

Initial tests of a carbon brush or tuft cathode intended for use by the Beam Research Program are reported. It was found that electric fields of approximately 100 kV/cm were required to produce current densities above 20 A/sq cm. The beam extracted from the cathode consisted of many beamlets, one for each tuft. The beamlets were found to be quite uniform in peak current density and the cathode operation was microscopically repeatable. The turn on time was estimated to be 200 ns. DOE

**N84-21821#** Argonne National Lab., Ill. Chemical Technology Div.

**IMPACT OF MONOBLOCK DESIGN AND BATTERY PACKAGING ON TEMPERATURE EXCURSION OF NICKEL/IRON BATTERIES**

Johnsee Lee, Clinton C. Christianson, and Neng-Ping Yao Feb. 1984 8 p refs Presented at the Intern. SAE Congr. and Exposition, Detroit, 27 Feb. 1984
(Contract W-31-109-eng-38)
(DE84-006444; CONF-840253-1) Avail: NTIS HC A02/MF A01

The temperature distribution exist between a single cell and a close pack 5 cell monoblock. During a three hour constant current discharge, the temperature of the monoblock exceeds the temperature limit set by the battery developer. This problem may be alleviated by providing intercell air spaces and applying forced air cooling to the battery. The importance of maintaining uniform air flow distribution in a full scale nickel/iron battery pack was also illustrated using an example. DOE

**N84-21822#** General Electric Co., Pittsfield, Mass. Power Transformer Dept.
**COMPACT GAS INSULATED TRANSFORMER Quarterly Report**
Jan. 1984 143 p refs Sponsored in part by the Empire State Electric Energy Research Corp. and the New York State Energy Research Development Authority and the Consolidated Edison Co. of N.Y. and the Niagara Mohawk Power Corp. of N.Y. and the Bonneville Power Administration
(Contract DE-AC02-79ET-29071)
(DE84-006426; DOE/ET-29071/15; QR-15) Avail: NTIS HC A07/MF A01

The development of design and manufacturing technologies is described. A transformer which is more efficient, more compact, lower in weight and audible sound, nonflammable, which does not rely upon mineral oil insulation, and which is compatible with the gas insulated electrical system of the future is designed. Design prototypes in the 50 MVA-345 kV range are to be tested. The program provides for economic, environmental, and systems application assessments of the emergent technologies. DOE

**N84-21823#** Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
**1 MEGAWATT, 100 GHz GYROTRON STUDY Final Report, 21 Mar. - 1 Sep. 1983**
N. J. Dionne, R. Mallavarpu, and A. Palevsky 21 Nov. 1983 70 p refs
(Contract W-7405-eng-26)
(DE84-006527; ORNL/Sub-83/59396/1) Avail: NTIS HC A04/MF A01

The results of a design study on a gyrotron device employing a new type of hollow gyrobeam formation system and having a capability for delivering magwatt CW power at 100 GHz to an ECRH-heated, magnetically-confined plasma are provided. The conceptual basis for the beam formation system is the tilt-angle gun (TAG) in which a conically-shaped electron beam is formed in a magnetically-shielded region and is then injected into the stray-field region of the main magnetic focusing system. Because fluid coolants are accessed through the central pole of the TAG-type gun, RF interaction is contemplated with cavity configurations not practical with the conventional MIG-type gyrobeam formation systems. DOE

**N84-21824#** Research Inst. of National Defence, Linkoeping (Sweden).
**CHARACTERIZATION OF MICROSTRIP FIXTURES, A BROADBAND MODEL FOR A MICROSTRIP CONNECTOR**
Gunnar Filipsson Sep. 1983 45 p refs
(FOA-C-30338-E; ISSN-0347-3708) Avail: NTIS HC A03/MF A01; Research Institute of National Defense, Stockholm, KR50

In order to improve the accuracy of measurements on microstrip components, a model for the connector was developed. Model element values were optimized to fit measured data. All S-parameters agree very well with the measured results up to 15 GHz. The measured device consisted of a 1 in. 500 hm microstrip transmission line between 2 connectors. Model predictions of behavior of a small gap in the line agree well with measurements. Results concerning a Lange coupler mounted in a microstrip fixture and the modeling of beam lead pin diodes are presented.
Author (ESA)

## 34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

**N84-21825** Prins Maurits Lab. TNO, Rijswijk (Netherlands).
**INVESTIGATION OF DETONATION CHAINS. PART 13: CONTINUOUS MEASUREMENT OF THE DETONATION VELOCITY OF PRESSED TNT USING AN ULTRAHIGH SPEED CAMERA [ONDERZOEK DETONATIEKETENS. 13: KONTINUE DETONATIESNELHEIDSMETING VAN GEPERST TROTYL MET BEHULP VAN EEN ULTRA-SNELLE CAMERA]**
J. D. Roest and A. A. Schilperoord Jan. 1982 17 p refs In DUTCH; ENGLISH summary
(Contract A78/KL/009)
(PML-1982-3; TDCK-77820) Avail: Issuing Activity

A method for the continuous measurement of the detonation velocity at the outside of pressed TNT using the Cording 200 high speed camera is described. Transparent plastic tape fixed on the explosive at the location of the record gives the best streak record. When the detonation is initiated by a detonator, the expansion of the detonation in the high explosive is spherical, beginning a few mm from the detonator-high explosive interface on a surface as large as the surface of the underside of the detonator. Author (ESA)

**N84-21826** Ruhr Univ., Bochum (West Germany). Inst. fuer Mechanik.
**AN EXTREMAL-VARIATIONAL PRINCIPLE FOR UNSTEADY THERMAL CONDUCTION APPLIED TO THERMOELASTIC PROBLEMS USING FINITE ELEMENTS Thesis [EIN EXTREMAL-VARIATIONSPRINZIP FUER DIE INSTATIONAERE WAERMELEITUNG MIT EINER ANWENDUNG AUF THERMOELASTISCHE PROBLEME UNTER VERWENDUNG DER FINITEN ELEMENTE]**
Bernd Kaempf Mar. 1983 134 p refs In GERMAN; ENGLISH summary
(Mitt-35) Copyright. Avail: Issuing Activity

Unsteady temperature field including a known heat source is described by an extremal-variational principle in the function space. Finite element method (FEM) programs for one and two dimensional bodies were developed. Examples were compared with known solutions and experimental results. The so determined temperature profile was applied to the principle of virtual work. Corresponding thermal stresses were calculated. An FEM program developed for this purpose was tested with single examples. Results demonstrate the validity of the theory. Author (ESA)

**N84-21827*#** Rensselaer Polytechnic Inst., Troy, N. Y.
**PHYSICAL PROCESSES IN FLUIDS Final Report, 1 May 1978 - 30 Sep. 1979**
Sydney Ross, Alan W. House, and Ralph E. Kornbrekke 14 Nov. 1980 68 p refs
(Contract NAS8-33074)
(NASA-CR-170990; NAS 1.26:170990) Avail: NTIS HC A04/MF A01 CSCL 20D

Results of various investigations of physical phenomena of fluids are reported. It was discovered that the morphology of an unstabilized liquid-liquid dispersion is predicted by a statistical law rather than a causal law. In addition, it was found that solution theory provides a model of homogeneous nucleation of a second immiscible liquid. The phase diagram and undercooling of the cyclohexane-methanol system was determined using microscopy. The contact angles between conjugate solutions of two binary systems were measured against glass at temperatures up to the critical temperature. M.G.

**N84-21828*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**REVIEW AND STATUS OF HEAT-TRANSFER TECHNOLOGY FOR INTERNAL PASSAGES OF AIR-COOLED TURBINE BLADES**
Frederick C. Yeh and Francis S. Stepka Apr. 1984 36 p refs
(NASA-TP-2232; E-1373; NAS 1.60:2232) Avail: NTIS HC A03/MF A01 CSCL 20D

Selected literature on heat-transfer and pressure losses for airflow through passages for several cooling methods generally applicable to gas turbine blades is reviewed. Some useful correlating equations are highlighted. The status of turbine-blade internal air-cooling technology for both nonrotating and rotating

blades is discussed and the areas where further research is needed are indicated. The cooling methods considered include convection cooling in passages, impingement cooling at the leading edge and at the midchord, and convection cooling in passages, augmented by pin fins and the use of roughened internal walls.
A.R.H.

**N84-21829#** Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
**NORMAL REFLECTION OF A SHOCK WAVE AT A RIGID WALL IN A DUSTY GAS**
H. Miura, T. Saito, and I. I. Glass Mar. 1984 42 p refs Sponsored in part by Natural Science and Engineering Research Council of Canada
(Contract DNA001-83-C-0266; Grant AF-AFOSR-0096-82)
(UTIAS-274; ISSN-0082-5255) Avail: NTIS HC A03/MF A01

Dusty-gas shock wave flows offer important examples of two phase relaxation phenomena. Experimental studies were carried out using a dusty-gas shock tube for understanding the interaction between a gas and a number of solid particles. On the analytical side, the formation of a shock wave in a dusty-gas shock tube was studied numerically. Unfortunately, a straightforward comparison of the theoretical and the experimental results was not possible owing to the assumption that the distributions of the number and size of particles are uniform did not apply in the experiments. However, the analyses provided a good estimate of the relaxation time and length of a shock wave in a dusty-gas flow. The basic nature of shock-wave reflection in a dusty gas by means of an equilibrium-gas analysis is clarified. Numerical solutions of the equations of motion are also presented to show the detailed change of the flow structure with time. Author

**N84-21830#** Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
**LASER DOPPLER VELOCIMETRY MEASUREMENTS OF MEAN VELOCITY AND TURBULENT STRESS TENSOR COMPONENTS IN A FREE ISOTHERMAL SWIRLING JET**
J. P. Sislian and R. A. Cusworth Mar. 1984 119 p refs Sponsored by Natural Sciences and Engineering Research Council of Canada
(UTIAS-281; ISSN-0082-5255) Avail: NTIS HC A06/MF A01

Measured values of three components of mean velocity and the six components of the turbulent stress tensor are reported in free, isothermal, axisymmetric, swirling jet flows representative of combustor swirl flows. Data was provided against which results of numerical prediction procedures are compared, and quantitative information on the behavior of all turbulent stresses and their correlation to spatial distribution of mean velocity gradients, with a view on improving our understanding of relevant transport processes and on guiding turbulence modelling and prediction efforts of such flows. From measured distributions of the mean velocities and various shear stress components, effective viscosity distributions are derived. Significant radial variation of effective viscosity is shown together with considerable anisotropy of turbulence. Finally, experimental data indicate a strong dependence of the turbulent stresses on the local strain of the mean flow, which suggests that an eddy viscosity type turbulence model rather than a Reynolds stress model is acceptable for the prediction of such flows. Author

**N84-21831*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**TURBULENCE STRUCTURES ASSOCIATED WITH THE BURSTING EVENT**
John Kim Apr. 1984 29 p refs
(NASA-TM-85944; A-9692; NAS 1.15:85944) Avail: NTIS HC A03/MF A01 CSCL 20D

Turbulence structures in a wall bounded shear layer during the bursting event detected by a conditional sampling technique are investigated using data obtained from large eddy simulation of turbulent channel flow. Streamlines are constructed from the ensemble-averaged velocity field to illustrate the flow patterns associated with the bursting event. The spatting motions during the sweep event and the existence of a pair of counterrotating streamwise vortices during the ejection process are exhibited.
Author

**N84-21832*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EFFECT OF A ROTOR WAKE ON HEAT TRANSFER FROM A CIRCULAR CYLINDER**
Robert J. Simoneau, Kim A. Morehouse, G. James VanFossen, and Frank P. Behning 8 Aug. 1984 18 p refs Proposed for presentation at 22nd Natl. Heat Transfer Conf., New York, 5-8 Aug. 1984; sponsored by ASME and AIchE
(NASA-TM-83613; E-2039; NAS 1.15:83613) Avail: NTIS HC A02/MF A01 CSCL 20D

The effect of a rotor wake on heat transfer to a downstream stator was investigated. The rotor was modeled with a spoked wheel of 24 circular pins 1.59 mm in diameter. One of the stator pins was electrically heated in the midspan region and circumferentially averaged heat transfer coefficients were obtained. The experiment was run in an annular flow wind tunnel using air at ambient temperature and pressure. Reynolds numbers based on stator cylinder diameter ranged from .001 to .00001. Rotor blade passing frequencies ranged from zero to 2500 Hz. Stationary grids were used to vary the rotor inlet turbulence from one to four percent. The rotor-stator spacings were one and two stator pin diameters. In addition to the heat transfer coefficients, turbulence spectra and ensemble averaged wake profiles were measured. At the higher Reynolds numbers, which is the primary range of interest for turbulent heat transfer, the rotor wakes increased Nusselt number from 10 to 45 percent depending on conditions. At lower Reynolds numbers the effect was as much as a factor of two.
Author

**N84-21833*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**A COMPRESSIBLE NAVIER-STOKES CODE FOR TURBULENT FLOW MODELING**
Thomas J. Coakley Feb. 1984 33 p refs
(NASA-TM-85899; A-9669; NAS 1.15:85899) Avail: NTIS HC A03/MF A01 CSCL 20D

An implicit, finite volume code for solving two dimensional, compressible turbulent flows is described. Second order upwind differencing of the inviscid terms of the equations is used to enhance stability and accuracy. A diagonal form of the implicit algorithm is used to improve efficiency. Several zero and two equation turbulence models are incorporated to study their impact on overall flow modeling accuracy. Applications to external and internal flows are discussed. E.A.K.

**N84-21834#** Wisconsin Univ., Madison. Mathematics Research Center.
**TWO-FLUID COUETTE FLOW BETWEEN CONCENTRIC CYLINDERS Technical Summary Report**
Yuriko Renardy and Daniel D. Joseph (Minnesota Univ., Minneapolis) Jan. 1984 29 p
(Contract DAAG29-80-C-0041)
(AD-A137969; MRC-TSR-2622) Avail: NTIS HC A03/MF A01 CSCL 20/4

This document considers the flow of two immiscible fluids lying between concentric cylinders when the outer cylinder is fixed and the inner one rotates. The interface is assumed to be concentric with the cylinders and gravitational effects are neglected. The authors present a numerical study of the effect of different viscosities, different densities and surface tension on the linear stability of the Couette flow. Their results indicate that with surface tension, a thin layer of the less viscous fluid next to either cylinder is linearly stable and that it is possible to have stability with the less dense fluid lying outside. The stable configuration with the less viscous fluid next to the inner cylinder is more stable than the one with the less viscous fluid next to the outer cylinder. The onset of Taylor instability for one-fluid flow may be delayed by the addition of a thin layer of less viscous fluid on the inner wall

and promoted by a layer of more viscous fluid on the inner wall.
Author (GRA)

**N84-21835#** California Univ., Berkeley. Dept. of Chemical Engineering.
**MEASUREMENT OF FAST TRANSIENT AND STEADY STATE RESPONSES OF VISCOELASTIC FLUIDS WITH A SLIDING CYLINDER RHEOMETER EXECUTING COAXIAL DISPLACEMENTS**
A. T. Tsai and D. S. Soong 9 Feb. 1984 31 p Submitted for publication
(Contract N00014-81-K-0516)
(AD-A137996; TR-6) Avail: NTIS HC A03/MF A01 CSCL 20/4

A Sliding Cylinder Rheometer (SCR) has been constructed for use with an existing Materials Test System (MTS) for the measurement of fast transient and steady-state responses of viscoelastic fluids in simple shear. Shearing is accomplished via coaxial displacement of the outer cylinder, while the inner one is held stationary. Matching pairs of circular rod and cylinder with precise dimensions, and thus well-defined annular spacings, are commercially available. The inner rod is threaded at one end for attachment to the load cell of the MTS, while flanges are welded to the outer cylinder for coupling to a cup mounted on the actuator of the MTS. Loading of the test sample is easily accomplished by raising the cup, and squeezing the fluid upwards into the annular spacing. During testing, the cup is replaced by one with large holes to eliminate pressure buildup due to compression of trapped air. This MTS-SCR combination capitalizes on the versatility and capability of the MTS programmable drive system, while the design of the SCR ensures the ideal simple shearing configuration. Experience with this new system indicates that SCR is not only less expensive to construct but also easier to use than the Parallel-Plate Rheometer (PPR) recently developed in this laboratory. GRA

**N84-21836#** DCW Industries, La Canada, Calif.
**DEVELOPMENT OF A COMPLETE MODEL OF TURBULENCE REVISITED**
D. C. Wilcox Dec. 1983 60 p
(Contract DAAG29-83-C-0003)
(AD-A138145; DCW-R-29-01; ARO-19572.1-EG-S) Avail: NTIS HC A04/MF A01 CSCL 20/4

A comprehensive and critical review of closure approximations for two equation turbulence models has been made. Particular attention has focused upon the scale-determining equation in an attempt to find the optimum choice of dependent variable and closure approximations. Using a combination of singular perturbation methods and numerical computations, this report demonstrates: (1) conventional k-e and k-omega sq formulations generally are inaccurate for boundary layers in adverse pressure gradient; (2) using so-called wall functions tends to mask such models' shortcomings; and (3) there exists a more suitable choice of dependent variables which is far more accurate for adverse pressure gradient. Author (GRA)

**N84-21837#** Iowa Univ., Iowa City. Inst. of Hydraulic Research.
**STUDY OF UNSTEADY TURBULENT BOUNDARY LAYERS Interim Technical Report, 1 Sep. 1980 - 31 Oct. 1983**
A. N. Menendez and B. R. Ramaprian 31 Dec. 1983 222 p
(Contract DAAG29-83-K-0004; Grant DAAG29-79-G-0017)
(AD-A138156; IIHR-270) Avail: NTIS HC A10/MF A01 CSCL 20/4

A turbulent boundary layer, subjected to a free-stream velocity which changes sinusiodally in time under a zero time mean pressure gradient, is studied both experimentally and analytically. Using a two-component Laser Doppler Anemometer and a Heat Flux Gage, detailed and high quality information is obtained on the instantaneous velocity distribution and wall shear stress, respectively, at various stations. An asymptotic theory, for large Reynolds numbers, is developed for the oscillatory motion. It is valid for both boundary layers at arbitrary time-mean pressure gradients and fully developed pipe and channel flow, and is successfully applied to the present and previous available experimental information. The theory identifies two frequency parameters, in terms of which four different frequency regimes are defined. Similarity laws are identified for each one of these frequency regimes. All the experimental data have been archived on magnetic tape. Author (GRA)

**N84-21838#** Thermo Electron Engineering Corp., Waltham, Mass.
**HIGH-TEMPERATURE CVD HEAT PIPE DEVELOPMENT Final Report**
Apr. 1983 100 p refs
(Contract DE-AC02-81CS-90215)
(DE83-017893; DOE/CS-90215/T1) Avail: NTIS HC A05/MF A01

The development of a high temperature chemical vapor deposition heat pipe (HT CVD HP) is summarized. The detailed development of the CVD heat pipes is discussed, including: construction of CVD reactors, construction of lithium charging station, refinement of burn off procedure, CVD heat pipe development and fabrication, test results, and potential applications. DOE

**N84-21839#** Grumman Aerospace Corp., Bethpage, N.Y.
**DIRECT-CONTACT HIGH-TEMPERATURE THERMAL ENERGY STORAGE HEAT EXCHANGER Final Subcontract Report**
Joseph Alario and Richard Brown Sep. 1983 88 p
(Contracts DE-AC02-83CH-10093; EG-77-C-01-4042)
(DE84-000012; SERI/STR-230-2065) Avail: NTIS HC A05/MF A01

A 10 kWh scale model high temperature direct contact latent heat exchange thermal energy storage system was fabricated. A research program was structured in three separate phases: (1) the inspection and evaluation of the original hardware, which suffered extensive corrosion and damage in a previous experimental program; (2) redesign and fabrication of a modified system, and (3) detailed test evaluation. In phase 1, the design was modified to eliminate previous deficiencies. Phase 2 entailed component procurement and fabrication, system assembly, and instrumentation. The results for the design and fabrication phases of the program are presented. DOE

**N84-21840#** National Center for Appropriate Technology, Butte, Mont.
**USING THE EARTH TO HEAT AND COOL HOMES**
Oct. 1983 23 p refs
(Contract DE-AC01-82CE-15095)
(DE84-007102; DOE/CE-15095/6) Avail: NTIS HC A02/MF A01; Also available at SOD HC

The types of earth- and water-coupled systems available are described. More information on the advantages and drawbacks of these systems is provided. A five-step, decision-making process that helps the consumer decide which system, if any, is most appropriate for his or her situation is also included. The systems used by several grantees from the US Department of Energy's Appropriate Technology Small Grants Program are described and some of the lessons they learned about this technology are highlighted. A resource list is provided that includes current literature on the technology, organizations that can provide more information, and what to look for when shopping for system equipment. DOE

**N84-21841#** Brown Univ., Providence, R. I. Div. of Engineering.
**TWO-PHASE FLUID FLOW THROUGH NOZZLES AND ABRUPT ENLARGEMENTS**
H. Olia, P. F. Maeder, R. DiPippo (Univ. of Southeastern Massachusetts), and D. A. Dickinson Oct. 1983 45 p refs
(Contract W-7405-eng-36)
(DE84-006991; LA-UR-83-3695; GEOFLO/19) Avail: NTIS HC A03/MF A01

The problem of a critical flow of two-phase mixture, boosted to a selected stagnation state and allowed to flow through a nozzle orifice into a long straight tube, is treated generically and analytically, making use of the basic laws of fluid mechanics and thermodynamics. Specific calculations were performed using R-114 as the flowing medium. An attempt is made to identify and describe

all possible flow conditions in and downstream of the nozzle for all possible stagnation conditions. DOE

**N84-21842#** Battelle Columbus Labs., Ohio.
**TECHNICAL AND ECONOMIC FEASIBILITY OF HORIZONTAL, MULTIPLE SHALLOW-WELL, AND DEEP-WELL GROUND COUPLING FOR RESIDENTIAL HEAT PUMP APPLICATIONS Final Report**
Robert D. Fischer and George H. Stickford, Jr. Jan. 1984 74 p refs
(Contract W-7405-eng-26)
(DE84-006244; ORNL/Sub-80-7800/3-06) Avail: NTIS HC A04/MF A01

An analytical assessment of ground-coupled heat pump systems in ten representative cities of the United States showed that simple payback relative to air-source heat pumps is shortest for deep-well ground-coil systems and ranged from 8 to 10 years in three cities, 12 to 15 years in two cities, and above 30 years in Seattle which has low electrical rates and space conditioning loads. Simple payback with any of three types of ground-coil systems is non-existent in Phoenix and Houston, which have highest cooling loads and low water table. Simple payback with horizontal ground-coil systems was only slightly longer than with deep-well systems. Deep-well ground-coil systems had shorter simple payback than multiple shallow-well systems, particularly in areas where deep wells can be drilled into rock layers. Life-cycle costs with a real discount rate of 2.0 percent for horizontal and deep-well ground-coil systems were shorter than that for air-source systems in all cities except for Phoenix, Houston, and Seattle. Seasonal heating coefficient of performance for the ground-coupled systems varied between 2.0 to 3.1 compared to 1.7 to 2.0 for air-source systems. Values of seasonal cooling coefficient of performance for ground-coupled systems were highest with the single deep-well coil. Cooling COP values with a horizontal coil were generally equal to or lower than values for air-source systems. Cooling COP values for air-source systems were higher than values for ground-coupled systems in southern climates with higher cooling loads. DOE

**N84-21843#** California Univ., Livermore. Lawrence Livermore Lab.
**TURBULENT BOUNDARY LAYER THERMOCHEMICAL ATTACK ON COATED WALLS**
Alfred C. Buckingham Jan. 1984 11 p refs Presented at the JANNAF Propulsion Meeting, New Orleans, 7-9 Feb. 1984 Sponsored in part by the U.S. Army ARRADCOM
(Contract W-7405-eng-48)
(DE84-005892; UCRL-89369; CONF-840250-1) Avail: NTIS HC A02/MF A01

Recent theoretical predictions of turbulent forced convection heat transfer in erosive corrosive gun tube propellant particle laden flow are extended for consideration of gas phase to solid surface reaction kinetics. Particle loading and boundary layer particle dispersal were shown, in these predictions, to directly inhibit kinetic and turbulent eddy diffusion processes and so to reduce the intensity of the turbulence in the boundary layer which forms adjacent to solid boundaries. The net predicted result is a significant reduction in erosive/corrosive wall heat transfer and a consequent significant reduction in wall material erosion. These predictions were confirmed by comparison with experimental observations, some of which are also summarized. However, the primary attention here is placed on combined gas phase and gas/surface combustion reaction influences with gun steel and refractory metal wall coatings in the presence of dispersed phase solid particles. Surface heating, substrate bond failure, crack initiation, and rate dependent surface material loss are also considered. DOE

**N84-21844#** Technische Hogeschool, Delft (Netherlands). Luchtvaart-en Ruimrevaarttechniek.
**INVESTIGATION OF THE LAMINAR TURBULENT BOUNDARY LAYER TRANSITION ON THE ROTOR BLADES OF THE 25 m WIND TURBINE HAT [ONDERZOEK NAAR DE OMSLAG LAMINAR-TURBULENT VAN DE GRENSLAAG OP DE ROTORBLADEN VAN DE 25M HAT WINDTURBINE]**
G. J. H. vanGroenewoud, L. M. M. Boermans, and J. L. vanIngen May 1983 43 p refs In DUTCH
(VTH-LR-390) Avail: NTIS HC A03/MF A01

Measurements were performed on a 25m horizontal axis wind turbine to see if blade contraction is sufficiently smooth for laminar flow after 2 years of weather exposure. Small microphones fixed on the blade detected fluctuating pressure signals in the turbulent boundary layer. The results show that laminar flow is possible without blade maintenance, and that centrifugal forces do not play a big role in the development of the turbulent boundary layer. The transition layer position agrees well with the results of a two dimensional calculation method, which also gives reasonable results in the determination of the critical toughness height. Author (ESA)

**N84-21845#** Technische Hochschule, Darmstadt (West Germany). Fachbereich Mathematik.
**A STOCHASTIC METHOD IN HYDRAULIC DESIGN OF OPEN CHANNELS**
Shan Pei Mao and Ke Chung Huang Dec. 1983 11 p refs Submitted for publication
(Preprint-790) Avail: NTIS HC A02/MF A01

A stochastic method for hydraulic design in open channels, based on the concept of reliability of discharge is proposed. The classical method of certainty is used to calculate all the unknown hydraulic factors in the discharge function. For a given expectation of a really occurred discharge and coefficient of variation of a discharge, the designed discharge/probability of designed discharge (G) curve can be plotted, giving a concept referring to the probability of the really occurred discharge. If the calculated G is too small to satisfy the demand of design, it can be improved through enlargement of the cross section. Author (ESA)

**N84-21846#** Technische Hochschule, Darmstadt (West Germany). Fachbereich Mathematik.
**A SOLUTION TO THE PROBLEM OF THE FLOW AROUND A CIRCULAR CYLINDER BETWEEN TWO PARALLEL PLATES WITH THE MONTE CARLO METHOD**
Shan Pei Mao and Ke Chung Huang Dec. 1983 10 p refs Submitted for publication
(Preprint-791) Avail: NTIS HC A02/MF A01

Computer generated pseudorandom numbers were used to simulate a two dimensional random walk and to solve the equations of flow around a circular cylinder between two parallel plates. With the Monte Carlo method, only those joints which are needed are calculated. With the finite element method or difference equations the simultaneous equations for all joints must be solved. If all joints of the lattice need to be calculated, then the Monte Carlo method uses more computing time than the others, and it is difficult to exactly estimate the error. Author (ESA)

**N84-21847#** Technische Hochschule, Darmstadt (West Germany). Fachbereich Mathematik.
**THE PROBABILISTIC ANALYSIS ON THE INFLUENCE OF ROUGHNESS TO DEPTH AND VELOCITY IN OPEN CHANNELS**
Shan Pei Mao and Ke Chung Huang Dec. 1983 12 p refs Submitted for publication
(Preprint-792) Avail: NTIS HC A02/MF A01

The random variation of depth and velocity in two dimensional uniform flow, given the stochastic characteristics of roughness in open channels is studied. The probabilities, mathematical expectations, variances of depth and velocity, and the correlations between roughness, depth and velocity are discussed. Author (ESA)

**N84-21848#** Technische Hochschule, Darmstadt (West Germany). Fachbereich Mathematik.
**THE INVARIANCE OF CONES AND WEDGES UNDER FLOWS**
Joachim Hilgert and Karl H. Hofmann Dec. 1983 15 p refs Submitted for publication
(Preprint-796) Avail: NTIS HC A02/MF A01

A finite dimensional real vector space L and a vector field X:L mapping L satisfying a Lipschitz condition are considered. If W is a closed subset of L, then many applications demand precise information about conditions on the vector field X which assure that the flow associated with it respects the closed set W. For u: [0,T] mapping L is an integral curve of the differential equation u(t) = X(u(t)), u(0) = uo with uo a member of W, u's continuing membership of W is discussed. Author (ESA)

**N84-21499#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**REPORT BY THE CHAIRMAN OF THE FLUID DYNAMICS PANEL**
B. Monnerie (ONERA, Paris) *In its* AGARD Highlights, Mar. 1984 Mar. 1984 p 5-15 In FRENCH (For primary document see N84-21498 12-01)
Avail: NTIS HC A04/MF A01

# 35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

**N84-21849*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**MEASUREMENT OF FLUID PROPERTIES USING RAPID-DOUBLE-EXPOSURE AND TIME-AVERAGE HOLOGRAPHIC INTERFEROMETRY**
Arthur J. Decker 13 Jun. 1984 12 p refs Proposed for presentation at 20th Joint Propulsion Conf., Cincinnati, 11-13 Jun. 1984; sponsored by AIAA and SAE and ASME
(NASA-TM-83630; E-2067; NAS 1.15:83630) Avail: NTIS HC A02/MF A01 CSCL 14B

The holographic recording of the time history of a flow feature in three dimensions is discussed. The use of diffuse illumination holographic interferometry or the three dimensional visualization of flow features such as shock waves and turbulent eddies is described. The double-exposure and time-average methods are compared using the characteristic function and the results from a flow simulator. A time history requires a large hologram recording rate. Results of holographic cinematography of the shock waves in a flutter cascade are presented as an example. Future directions of this effort, including the availability and development of suitable lasers, are discussed. Author

**N84-21850#** National Aerospace Lab., Tokyo (Japan).
**A TRANSPORTABLE CRYOSTAT**
Yukio Kurota, Kazuo Kusaka, and Tatsuo Kumagai 1983 20 p refs In JAPANESE; ENGLISH summary
(NAL-TR-791; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

A transportable cryostat was developed for the calibration for thermometers at low temperatures between 20K and 150K. This calibration is easy to handle, transportable, and yet has high calibration precision. Six calibrated Si diodes imbedded in the uniform temperature copper block were used for a check of the uniformity of temperature within the block. The temperature gradient in the copper block was shown to be negligible Calibration tests of thermometers showed that the calibration precision of the system was within + or - 0.2K. The calibration time for one temperature was about 10 minutes. It was confirmed that an Si diode is a useful and economic thermometer for precise measurements of temperatures near the boiling point of nitrogen and oxygen and this system is useful for the calibration of thermometers at low temperatures. M.G.

**N84-21851#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**IMPLEMENTATION AND EVALUATION OF TWO DESIGN CONCEPTS OF THE PASSIVE RING RESONATOR LASER GYROSCOPE M.S. Thesis**
M. E. Nelson Dec. 1983 95 p
(AD-A138064; AFIT/GEO/EE/83D-3) Avail: NTIS HC A05/MF A01 CSCL 17/7

Two configurations of the passive resonant ring laser gyroscope were evaluated. The first configuration detected cavity resonance by monitoring the beams transmitted through the cavity. The second configuration detected resonance by monitoring the beams reflected from the cavity input mirrors. The resonant cavity of both configurations had a rated finesse of 9800, making the gyro much more sensitive than earlier versions. Additionally, much of the cavity noise that plagued earlier experiments was eliminated by mounting the cavity mirrors on a solid ceramic block, and evacuating the beam paths. Alignment data indicated that the signal strength in the reflected beam had six times the power of the signal in the transmitted beam. However, the bias on the reflected signal was seven times the signal strength. This bias intensity increased the shot noise in the detector circuit. Rotation was simulated in the gyro by shifting beam frequencies. The strength of the error signal was calibrate to angular rotation. A signal to noise ratio of one was then converted to a noise equivalent rotation. Using a 100 second integration time, the noise equivalent rotation of the first configuration was 12 milliearthrate, and four milliearthrate for the second configuration. The detection of resonance using the reflected beam increased sensitivity threefold. GRA

**N84-21852#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**DEPENDENCE OF HOLOGRAPHIC GRATING FORMATION UPON INTERFERENCE PATTERN ORIENTATION IN BISMUTH SILICON OXIDE M.S. Thesis**
C. L. Matson Dec. 1983 101 p
(AD-A138099; AFIT/GEO/EE/83D-4) Avail: NTIS HC A06/MF A01 CSCL 20/6

Bismuth silicon oxide (BSO) is a material which shows good promise for use as a reusable holographic storage medium, with cycle times on the order of milliseconds. When operated without an applied voltage, fringe patterns are weakly recorded through a space charge field in the crystal equally well for all fringe orientations. The fringes are recorded much more strongly in the crystal when a field of 5 to 10 kV/cm is placed across the crystal; however, strength of fringe storage becomes dependent on the orientation of the fringes upon the crystal. Thus, it is necessary to determine how the strength of fringe storage depends upon the fringe angle to fully utilize the advantage of using an applied voltage to enhance crystal performance. A particularly simple hologram is made by interfering two plane waves, producing a sinusoidal interference pattern with parallel fringes. By measuring diffraction efficiencies of thick birefringent phase diffraction gratings formed in BSO by recording a sinusoidal interference pattern for a variety of fringe angles, the effect of fringe orientation upon fringe storage can be determined. This is the approach used in this thesis to analyze the fringe angle dependence of fringe storage in BSO. GRA

**N84-21853#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**LASER VELOCIMETER OPTICAL TRAVERSE SCHEME: AN INVESTIGATION OF A PROPOSED OPTICAL SCANNING TECHNIQUE FOR ARNOLD ENGINEERING AND DEVELOPMENT CENTER'S FOUR-FOOT TRANSONIC WIND TUNNEL M.S. Thesis**
Gary S. Krajci Dec. 1983 141 p
(AD-A138168; AFIT/GSO/MA/83D-2) Avail: NTIS HC A07/MF A01 CSCL 14/2

This investigation analyzed a nonstandard laser velocimeter setup proposed for use in AEDC Wind Tunnel 4T. The setup uses a gimballed mirror to move the probe volume from point to point,

and the translation of a lens to control the distance in the tunnel the probe volume reaches. Results show that for equal indices of refraction inside and outside the tunnel, the laser beams of a converging pair do not totally converge with its associated beam except under certain conditions, and the probe volumes created by each pair of overlapping laser beams do not always coincide. This work then provides the conditions necessary for total convergence of a pair of laser beams for this setup. A solution is then proposed to insure convergence of each laser beam pair and overlap of the two probe volumes. More than a solution to the above problems, a method is given to determine the azimuth and elevation angles for a mirror such that the reflected beam off the mirror passes through a given point in the tunnel after traversing a window. To carry out these investigations, a computer code was written to simulate the nonstandard laser velocimeter setup, and a second code was written to determine the azimuth and elevation angles for a mirror such that the reflected beam off the mirror passes through a given point in the tunnel after traversing a window. Both codes were written in FORTRAN 77, implemented on a CDC 6000-CYBER 74. GRA

**N84-21354#** Oak Ridge Gaseous Diffusion Plant, Tenn.
**TECHNIQUE FOR MODAL DATA ACQUISITION IN REMOTE LOCATIONS USING HAND PORTABLE INSTRUMENTATION**
W. D. Strunk and B. W. VanHoy Aug. 1983 8 p refs Presented at the Intern. Modal Anal. Conf., Orlando, Fla., 5 Feb. 1983
(Contract W-7405-eng-26)
(DE84-005755; K/D-5439) Avail: NTIS HC A02/MF A01

A successful method for collecting analog modal test data using hand portable, battery powered equipment successful at the various Department of Energy projects and facilities is described. Modal data is collected through the utilization of an impulse hammer and accelerometers (with battery powered charge or voltage amplifiers) directly onto a lightweight, battery powered instrumentation tape recorder. A small storage oscilloscope is used to ensure that the data being collected are within the dynamic range of the recorder. The recorded test data are then taken to a laboratory and entered into a modal analyzer. Amplitude differences of less than five percent were demonstrated in laboratory comparisons with standard data collection methods. All instrumentation is calibrated using NBS traceable standards. The total weight of the equipment is less than forty pounds which allows the collection of modal data at remote locations. Examples are given to show typical test setups and data taking practices that mitigate problems with dynamic range, distortion and extraneous noise. DOE

**N84-21855#** Los Alamos Scientific Lab., N. Mex.
**X-RAY IMAGING OF BIOLOGICAL SPECIMENS**
Johndale C. Solem 1983 7 p refs Presented at the 6th Intern. Conf. on Lasers and Applications, San Francisco, 12 Dec. 1983
(Contract W-7405-eng-36)
(DE84-006287; LA-UR-84-6; CONF-831265-2) Avail: NTIS HC A02/MF A01

Alternative techniques were compared for X-ray imaging of biological specimens on the basis of: (1) transverse and longitudinal resolution, (2) depth of field, (3) choice of recording medium, and (4) recording efficiency. For all imaging techniques, the dosages received by specimens were so high that the living state cannot be preserved, nor the structural integrity of the specimen be maintained in the usual sense. DOE

**N84-21856#** California Univ., Livermore. Lawrence Livermore Lab.
**EXTENDED-RANGE PENDULOUS VELOCITY GAGE**
Lawrence Starrh and Roger Noyes (Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho) 1983 20 p Presented at the 12th Transducer Workshop, Melbourne, Fla., 7 Jun. 1983
(Contract DE-AC08-83NV-10282)
(DE83-012749; EGG10282-1019; CONF-830639-2) Avail: NTIS HC A02/MF A01

The modification of a transducer to extend its dynamic range is described. These transducers are used to measure the response of geologic media to stress waves generated during and after underground tests performed by the Lawrence Livermore National Laboratory (LLNL) at the Department of Energy's Nevada Test Site. Included are descriptions of the previously used transducers as well as the modified transducers, their calibration and fielding. The successful extension of range of these transducers will allow the existing measurements system to be a more-valuable tool for the LLNL data analysts. The system will be used in the continuing effort to understand geologic phenomena of underground testing. DOE

**N84-21857#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abt. Stroemung und Verbrennung.
**HIGH SPEED PHOTOGRAPHY AND PULSED LASER HOLOGRAPHY FOR DIAGNOSTIC INVESTIGATIONS OF MIXTURE FORMATION AND VIBRATION IN RECIPROCATING ENGINES**
Herbert Wiegand, Kurt Wanders, Jochen Mueller (Kloeckner-Humboldt-Deutz AG), and Hans Steinbichler (Labor Dr. Steinbichler) Aug. 1983 30 p refs Presented at Intern. Conf. on Combustion in Eng., Oxford, 11-14 Apr. 1983
(DFVLR-Mitt-83-18) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 14

Using high speed photography, injection and mixture formation processes were recorded and the ignition delay time was determined at full load of a reference diesel engine at 2500 rpm. Pressure was measured by a quartz pressure transducer. Pressure increase was compared with ignition delay. Using holographic interferometry, the injection jet interaction with its environment in the atmosphere was shown. In order to identify the optimum points for fixing antiknocking sensors, holographic interferometry is recommended, because of its high local resolution. For localizing noise sources, holographic recording and evaluation of the vibration modes of complete engine transmission systems under sinusoidal and operational excitation is useful. Author (ESA)

**N84-21858#** Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany). Fachbereich Flugregelung und Navigation.
**VERTICAL GYRO WITH ERECTION SYSTEM AND INDICATION MECHANISM Final Report, Dec. 1981**
Peter Giesenberg Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 51 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-83-034; ISSN-0170-1339) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11

A demonstration model of a vertical gyro is presented. An erection system was developed and optimized. It contains no parts subject to wear, thus providing superior reliability and maintainability. Another concept was built with the gyro located in the indication sphere. Thus the mechanical setup is simplified and the length of the unit is reduced by 50 mm compared to similar gyros. Author (ESA)

# 36 LASERS AND MASERS

Includes parametric amplifiers.

**N84-21859#** Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
**TEMPORAL MEASUREMENT OF SPECTRALLY RESOLVED OUTPUT OF MULTILINE HF LASERS**
J. M. Bernard, D. H. Ross, J. G. Coffer, R. A. Chodzko, and S. B. Mason 31 Dec. 1983 23 p
(Contract F04701-83-C-0084)
(AD-A137983; TR-0084(4930-01)-4; SD-TR-83-99) Avail: NTIS HC A02/MF A01 CSCL 20/5

An indium-arsenide detector array installed at the focal plane of a grating spectrometer provides the time history of the intensity of each output line of multiline HF chemical lasers. The construction and calibration of this instrument are discussed, and representative

data presented. Line competition measurements are shown for a 200-W supersonic-diffusion-type HF laser; individual line outputs fluctuate more than total multiline output. The spectral effects of forward/reverse-wave competition on an unstable ring resonator operating at 350 W are detailed. Simultaneous single-line gain measurements on a multiline HF medium are demonstrated. Other applications of this useful instrument are discussed. Author (GRA)

**N84-21860#** Naval Research Lab., Washington, D. C.
**THE CONSTRUCTION OF A Nd:YAG LASER AND OBSERVATION OF THE OUTPUT M.S. Thesis**
Ki Hyun Chung Dec. 1983 64 p
(AD-A138055) Avail: NTIS HC A04/MF A01 CSCL 20/5

An experimental Neodymium YAG laser system has been constructed using a cylindrical pumping reflector containing three CW tungsten-halide lamps. Maximum laser output of 2.05 watts has been obtained with slope efficiency 0.19 percent at 3300 watts input power. Slope efficiency increased with increasing input power, and output power decreased with increasing resonator length. Author (GRA)

**N84-21861#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**ANALYSIS OF LASER SPOT QUALITY M.S. Thesis**
W. D. Pitts Dec. 1983 92 p
(AD-A138056; AFIT/GEO/PH/83D-5) Avail: NTIS HC A05/MF A01 CSCL 20/5

A four-moment method is presented to analyze the quality of laser beam spots. The first four central moments are calculated on two dimensional transverse intensity distributions of several laser spots. The four moments represent the center, spread, skewness, and peakness, respectively of the spot. A pure Gaussian and uniform intensity spot were included as controls. A photograph of each laser spot was scanned by a TV camera and digitized. Each spot generated 31K (31744) pixel elments of data. Each pixel was weighted by the intensity at that point. The data were then processed by a computer to get the moments. The first moment was reported as a pair of numbers, representing the coordinates of the center of the spot. The second, third and fourth moments were reported as four, eight and sixteen element tensors, respectively. An eigenvalue problem was formed from the second moment, yielding an angle of general spread from the center. Symmetric distributions, such as the Gaussian and uniform, showed near-zero third moments, as expected. The position of a spot only affected the first moment, as expected. The Gaussian and uniform distributions are ideals against which to compare other laser spots. GRA

**N84-21862#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**MICROWAVE EXCITATION OF A CO2 LASER M.S. Thesis**
R. C. Page Dec. 1983 98 p
(AD-A138057; AFIT/GEP/PH/83D-8) Avail: NTIS HC A05/MF A01 CSCL 20/5

A flowing carbon dioxide laser was operated at low pressures up to 4 torr. Excitation of the laser was provided using various combinations of direct current (dc), pulsed microwave, and continuous wave (CW) microwave excitation. The microwaves were in the 2.45 GHz band and were coupled into the gas using a slow-wave interdigital transmission line. Laser output of 25 milliwatts (mw) was achieved using a dc discharge only. A combination of a dc discharge and pulsed microwaves doubled the output and resulted in some modulation. Changing the laser gas mixture and pulsed microwave field characteristics allowed some flexibility in the modulation. Lasing was not achieved with excitation from the CW microwaves alone due to the formation of localized discharges. Using pulsed microwaves to sustain the discharge and CW microwaves to pump the laser, a quasi-CW output of 55 mw was achieved. Author (GRA)

**N84-21863#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**STUDY OF A TUNABLE CO2/N2O MEDIUM PRESSURE WAVEGUIDE LASER M.S. Thesis**
A. R. Bigelow Dec. 1983 94 p
(AD-A138076; AFIT/GEO/PH/83D-1) Avail: NTIS HC A05/MF A01 CSCL 20/5

The operational characteristics of a CO2 waveguide laser, capable of both inter-line and intra-line tuning, were investigated. This system exhibits an overall simplicity in design and construction. In addition, only inexpensive and readily available materials are required. The range of gas pressure in the discharge extended from 25 Torr to 162 Torr while using a 20/10/70 gas mixture of CO2.N2/He. The P(20) line, which was scanned using piezoelectric transducer, had a tunable linewidth of 215 MHz. This linewidth was limited by the 220 MHz free spectral range of the cavity. In the multi-line configuration, the maximum output was 7.5 W. A grating was used to achieve inter-line tuning; a total of 50 different lines of the P and R branches of the 10.4 m and 9.4 m lased. A maximum output power of 2.2W, P(20), was achieved during single line operation. A 9.9/9.8/80.3 gas multi-line configuration at maximum output of 825 mW was achieved. Author (GRA)

**N84-21864#** IBM Watson Research Center, Yorktown Heights, N.Y.
**LASER STUDIES OF MOLECULAR DYNAMICS Final Report, 25 Aug. 1980 - 24 Aug. 1983**
P. P. Sorokin 5 Dec. 1983 9 p
(Contract DAAG29-80-C-0131)
(AD-A138102; ARO-17266.5-PH) Avail: NTIS HC A02/MF A01 CSCL 07/4

Several objectives outlined in the original technical proposal Laser Studies of Molecular Dynamics were fulfilled in the work done under the three-year contract (25 August 1980-24 August 1983). A comparison of results that were actually achieved with our stated goals serves as the structure for this final report. GRA

**N84-21865#** Stanford Univ., Calif. Dept. of Chemistry.
**LASER DETECTION OF CHEMICAL AGENTS Final Report, 1 Sep. 1980 - 31 Aug. 1983**
R. N. Zare 1 Feb. 1984 6 p
(Contract DAAG29-80-K-0097)
(AD-A138122; ARO-17743.3-CH) Avail: NTIS HC A02/MF A01 CSCL 15/2

We have recently extended the gas-phase MPI technique to probe molecules absorbed on fused quartz surfaces. The phenomenology of the process is rich, showing wavelength-dependent fragmentation patterns. Our first generation surface/mass spectrometer system has a proven detectability limit of 4 less than 4 x 10 to the 13th power molecules of dimethyl methyl phosphonate (DMMP) corresponding to an exposure to a DMMP partial pressure of .0000001 Torr for 1 second. GRA

**N84-21866#** Stanford Univ., Calif. Lab. of Physics.
**DIODE PUMPED FIBER LASER Interim Technical Report, Apr. 1982 - May 1983**
M. J. F. Digonnet and H. J. Shaw Wright-Patterson AFB, Ohio AFWAL Jul. 1983 215 p
(Contract F33615-82-C-1749; AF Proj. 2001)
(AD-A138198; SU-GL-3582; AFWAL-TR-83-1110) Avail: NTIS HC A10/MF A01 CSCL 20/5

The objective of this program was the study and exploratory development of a miniature solid state laser source as a potential signal source in a variety of fiber optic sensors and systems. The specific source to be studied was composed of a single-crystal Neodymium-YAG optical fiber end-pumped with a single semiconductor laser diode. GRA

**N84-21867#** Naval Weapons Center, China Lake, Calif.
**A TECHNIQUE FOR INCREASING THE OPTICAL STRENGTH OF SINGLE-CRYSTAL NaCL AND KCL THROUGH TEMPERATURE CYCLING Interim Report**
J. B. Franck Dec. 1983 20 p
(AD-A138280; AD-E900318; NWC-TP-6464) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report relates a technique for increasing the optical

strength of NaCl and KCl single-crystal samples. The 1.06-micrometer pulsed laser damage thresholds were increased by factors as large as 4.6 for a bulk NaCl single-crystal sample. The bulk laser damage breakdown threshold (LDBT) of the crystal was measured prior to and after heat treatment at 800 degrees C using a Nd:YAG laser operating at 1.06 micrometer. Bulk and surface LDBTs were also studied on samples annealed at 400 degrees C. These samples showed differences in damage morphology on both cleaved and polished surfaces, and the cleaved surfaces had improved damage thresholds. However, neither the polished surfaces nor the bulk showed improved threshold at the lower annealing temperature. GRA

**N84-21868#** European Office of Aerospace Research and Development, FPO New York 09510.
**THE 16TH EUROPEAN CONFERENCE ON LASER INTERACTION WITH MATTER, BOOK OF ABSTRACTS**
30 Sep. 1983 141 p Proc. held in London, 26-30 Sep. 1983
(AD-A138316; EOARD-TR-84-06) Avail: NTIS HC A07/MF A01 CSCL 20/5

This document comprises a collection of abstracts of papers presented at the European Conference on Laser Interaction with Matter. GRA

**N84-21869#** Oklahoma State Univ., Stillwater.
**SPECTROSCOPIC INVESTIGATIONS OF MATERIALS FOR TUNABLE INFRARED LASERS Annual Progress Report, 1 Mar. 1983 - 28 Feb. 1984**
R. C. Powell 28 Feb. 1984 37 p
(Contract N00014-82-K-0109)
(AD-A138324; APR-2) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report describes research on the crystal growth and spectroscopic properties of 4d and 5d transition metal ions in halide and oxide hosts materials. Specific information is given on the fluorescence spectra and lifetimes of divalent Rh, Ru, Pt, and Ir ions in KBr and KCl crystals using time resolved laser pumping. Differences in spectral properties of charge transfer and d level emission are reported as a function of temperature, annealing and radiation treatments. The spectral properties appear to be suitable for laser materials if higher concentrations of doping can be achieved. Author (GRA)

**N84-21870#** Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
**LASER GENERATION OF ULTRASOUND Final Report**
M. J. Rudd and J. A. Doughty Warminster, Pa. Naval Air Development Center Feb. 1983 67 p
(Contract N62269-82-C-0442)
(AD-A138483; BBN-5273; NADC-81067-60) Avail: NTIS HC A04/MF A01 CSCL 14/2

The purpose of this report is to demonstrate a technique to generate high level, focused ultrasound by laser excitation of a material. The application is for ultrasonic nondestructive testing of components and possibly structures. The principle is that the laser energy is absorbed by a material and heats it, and the resulting thermal expansion generates a pressure wave in the material. An experimental and analytical study has been conducted into the use of carbon dioxide TEA lasers to generate ultrasonic waves. When the laser is fired at a plastic target, waves with a peak-to-peak pressure of 10 bars are generated. Teflon and Mylar were the most effective. There was no damage to the plastic, even after several hundred shots. This was not the case for glass or aluminum with a much smaller absorption depth and lower conversion efficiency. The sound wave could be directed by using an off-axis zone plate. This generated a 10 MHz tone burst, 45 deg, off-axis with a duration of 4 microsecs. A theoretical analysis of the phenomena is given which accounts for the waveforms and peak pressures measured. GRA

**N84-21871#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group 1: Physics.
**A CW-CO2 LASER RANGE FINDER USING HETERODYNE DETECTION AND ON-OFF AMPLITUDE MODULATION**
R. J. L. Lerou Aug. 1983 28 p refs
(Contract A77/KL/052)
(PhL-1983-34; TDCK-78299) Avail: NTIS HC A03/MF A01

A CO2 laser range finder that uses an acousto-optic modulator to obtain an amplitude modulated optical beam from a CW laser was built. An on-off deflected beam was obtained by driving the modulator with a carrier modulated by a periodic binary code. The received infrared radiation was heterodyne detected. After envelope detection of the heterodyne signal, the signal-to-noise ratio was improved by applying a digital integrator. Ranging was carried out by calculating the delay of the received code by cross correlation, using a minicomputer implemented in the system. Using 1 W average beam power and measuring time $< 1$ sec, ranges of several kilometers were determined from stationary targets. Author (ESA)

**N84-21658#** Joint Publications Research Service, Arlington, Va.
**LASER SCREENS OF ZnSe PRODUCED BY BRIDGEMAN METHOD Abstract Only**
M. P. Kulakov, G. A. Meyerovich, V. N. Ulasyuk, A. V. Fadeyev, and I. Sh. Khasanov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 43 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Neorganicheskiye Materialy (Moscow), v. 19, no. 11, Nov. 1983 p 1807-1810 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

# 37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

**N84-21872#** British Library Lending Div., Boston Spa (England).
**QUALITY AND RELIABILITY OF STEEL WIRE ROPES**
K. G. Zalyalyutdinov, P. M. Tsemoshevich, B. A. Igmetov, and N. T. Melnikova 31 Jan. 1984 15 p refs Transl. into ENGLISH from Stal (USSR), no. 5, 1983 p 68-72
(BLL-M-35461-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The main industries using steel wire rope in the USSR and their respective shares are considered together with some of the general features of rope manufacture, quality and range of application. Rope use in the mining, metallurgical and oil industries is considered in detail. More attention should be given to the specific utilization conditions as one of the ways of achieving better service performance and particular standards are recommended for ropes for use in some of the main applications. Measures for securing steady production of high performance ropes are listed. Author

**N84-21873** Prins Maurits Lab. TNO, Rijswijk (Netherlands).
**REGRESSION ANALYSIS OF FRAGMENT PERFORATION DATA [REGRESSIE-ANALYSE VAN SCHERFPERFORATIEGEGEVENS]**
L. C. R. J. Willenborg Jan. 1982 67 p refs In DUTCH; ENGLISH summary
(Contract A79/KL/130)
(PML-1982-4; TDCK-78192) Avail: Issuing Activity

Two regression analysis computer programs, MULIRE and DATRA, are discussed. The MULIRE program can be used to perform a (multi-) linear regression analysis of fragment perforation data. This regression is based on the Thor equations. With the DATRA program, data files which can serve as input files for MULIRE can be transformed. The programs are enclosed. Author (ESA)

**N84-21874#** Shock and Vibration Information Center (Defense), Washington, D. C.
**THE SHOCK AND VIBRATION DIGEST, VOLUME 16, NO. 2**
Judith Nagle-Eshleman, ed. Feb. 1984 84 p refs
(AD-A139098) Avail: SVIC, Naval Research Lab., Code 5804, Washington, D.C. 20375 CSCL 20/11

Shock and vibration methods, information systems, and research in the field are outlined. Its application to mechanical and electrical engineering, mathematics, physics, is discussed. For individual titles, see N84-21875 through N84-21876.

**N84-21875#** Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
**TURBULENT FLOW ANNULAR PUMP SEALS: A LITERATURE REVIEW**
L. E. Barrett *In* the Shock and Vibration Digest, Vol. 16, No. 2 Feb. 1984 p 3-13 refs (For primary document see N84-21874 12-37)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 13/11

The literature on turbulent flow annular seals including both theoretical and experimental work is reviewed. The application of these seals to main coolant pumps used in nuclear reactor facilities is emphasized. A numerical example for calculating the dynamic force coefficients for rotor dynamic response is presented together with design considerations relevant to main coolant pump applications. E.A.K.

**N84-21876#** Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Materials Lab.
**TOROSIONAL VIBRATION OF CRANKSHAFTS IN RECIPROCATING MACHINES**
D. K. Rao *In* the Shock and Vibration Digest, Vol. 16, No. 2 Feb. 1984 p 15-23 refs (For primary document see N84-21874 12-37)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 13/9

Torsional natural frequencies and vibratory stresses in reciprocating machinery shafting were determined. Crankshafts and connected shafting in reciprocating engine driven systems such as ship propulsion drives, air compressors, diesel generator sets, and automobiles which can fail if excessive torsional vibratory stresses are developed due to a torsional mismatch between driving and driven machinery are discussed. E.A.K.

**N84-21877*#** Department of Energy, Washington, D. C. Office of Vehicle and Engine Research and Development.
**PROCEEDINGS OF THE 20TH AUTOMOTIVE TECHNOLOGY DEVELOPMENT CONTRACTORS' COORDINATION MEETING**
Warrendale, Pa. Society of Automotive Engineers, Inc. Apr. 1983 366 p refs Proc. held in Dearborn, Mich., 25-28 Oct. 1982
(Contract DEN3-287)
(NASA-CR-173412; NAS 1.26:173412; DE83-016840; CONF-821055; ISBN-0-89883-081-8; P-120) Avail: NTIS HC A16/MF A01 CSCL 13I

Thirty-four papers are included which cover the following topics: stirling technology, gas turbines, ceramics, heavy duty transport, industry perspectives, and alternative fuels. B.G.

**N84-21878#** SKF Technology Services, King of Prussia, Pa.
**LUBRICATION OF ENGINEERING SURFACES, PHASE 2 Final Report**
John I. McCool Dec. 1983 180 p refs
(Contract DE-AC02-80ER-10693)
(DE84-006344; DOE/ER-10693/T2; AT83D043) Avail: NTIS HC A09/MF A01

Performance prediction for rolling sliding contacts in terms of the statistical microgeometry of the contacting bodies and the properties of the fluid medium that separates the surfaces is examined. The interrelated areas include: (1) development of an asperity contact model that accounts for the inherent directionality (anisotropy) that typifies real surfaces and that specifically reflects the effect of frequency content of the roughness process; (2) development of guidelines for preprocessing (filtering) roughness data and for assessing the distortional effect of stylus radius and flight, record length, sampling rate and quantization error on the generalized surface characterization required by the contact model; (3) delineate the limitations of the assumptions of mechanical and statistical independence and gaussianity, inherent in asperity contact models and the limitations of modelling a sperity shapes as 2nd order polynomials; (4) development and experimental validation of a combined fluid/coulomb model for predicting the traction transmitted when real surfaces undergo relative rolling and sliding in the important regime where the lubricant film is thin enough to permit some degree of asperity contact; and (5) generation and compilation of lubricant and surface roughness data required for contact performance prediction and quantification of the statistical error inherent in surface characterizations. DOE

**N84-21879*#** Garrett Turbine Engine Co., Phoenix, Ariz.
**ADVANCED TURBOCHARGER DESIGN STUDY PROGRAM Final Report**
D. G. Culy, R. W. Heldenbrand, and N. R. Richardson (Garrett Automotive Products Co., Torrance, Calif.) 1 Jan. 1984 193 p refs
(Contract NAS3-22750)
(NASA-CR-174633; NAS 1.26:174633; GTEC-21-4498) Avail: NTIS HC A09/MF A01 CSCL 21G

The advanced Turbocharger Design Study consisted of: (1) the evaluation of three advanced engine designs to determine their turbocharging requirements, and of technologies applicable to advanced turbocharger designs; (2) trade-off studies to define a turbocharger conceptual design and select the engine with the most representative requirements for turbocharging; (3) the preparation of a turbocharger conceptual design for the Curtiss Wright RC2-32 engine selected in the trade-off studies; and (4) the assessment of market impact and the preparation of a technology demonstration plan for the advanced turbocharger. Author

**N84-21880#** Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering.
**THE EFFECT OF FLUID INERTIA AND VISCOELASTICITY IN SQUEEZE-FILM DAMPER BEARINGS Final Report, 15 Sep. 1980 - 30 Nov. 1983**
J. A. Tichy Jan. 1984 28 p
(Contract DAAG29-80-K-0064)
(AD-A138054; ARO-17064.7-EG) Avail: NTIS HC A03/MF A01 CSCL 13/9

In the modeling and analysis of rotor dynamic systems, the behavior of squeeze film damper bearings is normally predicted by the Reynolds equation of hydrodynamic lubrication. Large bearing gaps and high speeds can combine to create conditions in practical applications where fluid inertia and viscoelastic effects may become significant, violating the assumptions under which Reynolds equation can be applied. The analysis shows that the results of lubrication theory can be greatly in error with regard to phase effects between bearing forces and displacements, which may have profound implications regarding critical speed and forced response behavior. Very large deviations from lubrication theory have been predicted in a series of analytical papers under this contract. In the present study direct measurements of damper forces are presented for the first time. Reynolds numbers up to ten are obtained at eccentricity ratios 0.2 and 0.5. Lubrication theory underpredicts the measured forces by up to a factor of two (100% error). Qualitative agreement is found with predictions of the improved theory which includes fluid inertia forces. GRA

**N84-21881#** Naval Ship Research and Development Center, Bethesda, Md.
**MECHANICAL FACE SEAL TECHNOLOGY: A LITERATURE SURVEY**
N. T. Sides Feb. 1984 23 p
(S12-57; SL0-01)
(AD-A138434; DTNSRDC-84/004) Avail: NTIS HC A02/MF A01 CSCL 11/1

A literature survey was conducted to review and evaluate the state of the art in mechanical face seal technology. The survey is part of a study to develop the capability of designing improved seals for Navy use. Sixty-eight references are cited and discussed. The report is subdivided into several sections, each embracing a general physical aspect of face seal operation. The difficulties in modeling seal performance are emphasized. Indeed, it is remark-

able and encouraging that several of the models developed do predict face seal performance with some degree of accuracy. GRA

**N84-21882#** California Univ., Berkeley. Dept. of Mechanical Engineering.
**MECHANICS OF PROJECTILE IMPACT AGAINST THIN PLATES Final Report, 18 Aug. 1980 - 31 Dec. 1983**
W. Goldsmith 1 Mar. 1984 10 p
(Contract DAAG29-80-K-0052)
(AD-A138494; UCB/AM-PP-1; ARO-17216.8-EG) Avail: NTIS HC A02/MF A01 CSCL 11/6

A comprehensive theoretical and experimental investigation was undertaken to study the effects of projectile impact on plates involving targets of soft aluminum and mild steel, with thicknesses ranging from 0.05 to 1 in. The preponderance of the tests and all analyses were concerned with normal impact; however, a substantial number of experiments involved oblique impact with angles up to 50 deg. Projectiles of 1/2-in. diameter consisted of hard-steel cylinders with masses of about 40 g, or of 16g soft aluminum cylinders. Strikers were fired pneumatically at velocities up to 600 ft/s, and with a powder gun up to 3000 ft/s where metallurgical post-impact target examinations were also performed. The test results correlated well with three different analytical predictions developed for the three nose shapes, respectively. A separate investigation of the influence of a predrilled hole in the target on central, normal impact of concial-nosed strikers evidenced a greater projectile energy loss than for an intact plate due to occurrence of extrusion rather than petalling for certain hole/projectile diameter ratios. Target deformation and fracture initiation was also extensively investigated experimentally just below and just above the ballistic limit. GRA

**N84-21883#** Ford Motor Co., Dearborn, Mich. Engineering and Research Staff.
**HC QUENCH LAYER FORMATION IN COMBUSTION PROCESSES Final Report**
G. A. Lavoie and A. A. Adamczyk Dec. 1983 129 p refs
(Contract DE-AC04-79ET-15303)
(DE84-005068; DOE/ET-15303/T7) Avail: NTIS HC A07/MF A01

Processes believed responsible for unburned hydrocarbon (HC) emissions in spark ignition engines were investigated. Combustion bombs fitted with identical turbulence generating inlet swirl systems were used to study the effect of turbulence on unburned HC emissions from wall quench and crevices. A model was developed to describe the turbulent wall quench layer in an engine and includes the cylinder wall oil film and ring crevices as additional sources of hydrocarbons which feed into the wall layer after combustion. It is shown that wall quench is not a major source of HC emissions in the bomb and that the effect of increased turbulence on the low emissions from wall quench is to reduce them further. It was found that emissions from crevices introduced into the bomb were more important than those from wall quenching. Turbulence did not greatly affect the HC emissions from the crevices. It was found that motion generated by the inlet system on the bombs approximates a solid body rotation with a decay time of 200 msec. The analytical model compared favorably with experimental engine data and supported the view that oil films and crevices are major sources of hydrocarbons in engine combustion. E.A.K.

**N84-21884#** California Univ., Livermore. Lawrence Livermore Lab.
**MECHANICAL ENGINEERING RESEARCH PROGRAM Quarterly Progress Report, Apr. - Jun. 1983**
Alfred Goldberg, comp. 9 Sep. 1983 46 p refs
(Contract W-7405-eng-48)
(DE84-001085; UCID-19323-83-2) Avail: NTIS HC A03/MF A01

Progress is briefly discussed in: an acoustic microscope for surface characterization, automatic spherical surface characterization, a diamond turning machine, multilayer coatings, characterization of martensitic transformations using acoustic emission, early characterization of graphite composites by fiber testing, a methodology for predicting aging of polymers, solid geometric modeling, and multivariable systems analysis and design. DOE

**N84-21885#** Bendix Corp., Kansas City, Mo.
**APPLYING ROBOTIC TECHNOLOGY TO THE SOLID FILM LUBRICANT BURNISHING OPERATION**
M. L. Fureigh Feb. 1984 17 p
(Contract DE-AC04-76DP-00613)
(DE84-007113; BDX-613-3017) Avail: NTIS HC A02/MF A01

The PUMA 260, a programmable robot, was used to burnish up to 22 different parts coated with solid film lubricant in the painting department. Some other parts also are potential candidates for robotic applications. Robot technology can reduce the burnishing operation standard hours and relieve workers' fatigue and strain as well as produce more uniform part to part quality. Using VAL, the versatile computer program language for PUMA 260, the process engineer can define the optimum robot burnishing actions and speeds for each part. DOE

**N84-21886#** Technische Hogeschool, Delft (Netherlands). Lab. fuer Mechanisierung der Produktion und fuer Mechanismen.
**DISPLACEMENT ANGLE RELATION FOR THE CROSS CRANK MECHANISM: AN EXACT KINEMATIC MEASURE SYNTHESIS [WEG-WINKEL-ZUORDNUNG FUER DEN KREUZSCHUBKURBEL-MECHANISMUS - EINE EXAKTE KINEMATISCHE MASSSYNTHESE]**
H. Rankers Apr. 1983 13 p refs In DUTCH
(WTHD-155) Avail: NTIS HC A02/MF A01

The displacement angle relation of the cross crank mechanism was represented by p=krm parameters. The synthesis requires a system with p linear equations. Very simple and compact algorithms with given pseudoparameters were obtained by the Type and Dimension Synthesis of Function Generators, written in FORTRAN, a component of the computer aided design program packet CADOM. Author (ESA)

**N84-21887#** Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
**RUNNING STABILITY OF LARGE ROTOR BEARING FOUNDATION MODELS Final Report [LAUFSTABILITAET GROSSER ROTOR-GLEIRLAGER-FUNDAMENT-KONSTRUKTIONEN]**
D. Bosin 1983 71 p refs In GERMAN; ENGLISH summary
(Contracts DFG-Ga-187/9; DFG-Ga-187/12; DFG-Ga-187/14)
(ILR-Mitt-124/1983) Avail: NTIS HC A04/MF A01

A finite element model of large turborotors including stiffness and damping of bearings and foundation and rotor stiffness was developed. A modal condensation procedure was employed to reduce substructure unknowns and the stability limit was iterated by eigenvalue computation. Threshold speed and unstable eigenfrequency was calculated for a system of 16 reduced degrees of freedom (rotor-bearing model) and for a system of 46 reduced degrees of freedom (rotor-bearing-foundation model). The influence of rotor mass and stiffness, oil film stiffness and damping, Sommerfeld number, types of journal bearings, and mass, stiffness, and damping of the foundation was studied. It is concluded that a realistic stability analysis has to be calculated with the coupled rotor-bearing-foundation-model. Author (ESA)

**N84-21888#** General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
**STIRLING ENGINE APPLICATIONS STUDY Final Report, Jan. - Dec. 1982**
K. L. Hanson, S. E. Eckard, R. McCarthy, R. Spera, and Z. Antoniak Aug. 1983 236 p refs Sponsored by Gas Research Institute
(PB84-148055; GE-82AEP022; GRI-81/0133) Avail: NTIS HC A11/MF A01 CSCL 21G

A comprehensive survey of the potential applications for gas-fired, stationary Stirling engines was conducted. Engine characteristics were determined from a literature search and personal contacts. Such attributes as multi-fuel capability, low emissions (noise and chemical pollutants), and good part load efficiency were verified. Its thermal efficiency (demonstrated and

potential) was found to be approximately equal to the diesel engine. Its potential cost is estimated to exceed that of a diesel engine.
GRA

**N84-21651#** Joint Publications Research Service, Arlington, Va.
**NEW METHOD AND EQUIPMENT FOR HIGH-FREQUENCY WELDING OF PIPE**
V. Paton *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 34-36 Transl. into ENGLISH from Sots. Industriya (Moscow), 2 Oct. 1983 p 2 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21652#** Joint Publications Research Service, Arlington, Va.
**WELDING WITH ALLOYING AND ULTRASONIC TREATMENT WITH AN ION BEAM Abstract Only**
B. Ye. Paton, M. D. Gabovich, S. M. Gurevich, V. N. Zamkov, V. Ya. Poritskiy, and A. D. Shevelev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 37 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 273, no. 1, Nov. 1983 p 104-106 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21653#** Joint Publications Research Service, Arlington, Va.
**OVERALL MECHANIZATION OF ASSEMBLY AND WELDING PROCESSES IN THE MANUFACTURE OF SHIPS' STRUCTURES Abstract Only**
Yu. I. Simonov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 37-38 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 10, Oct. 1983 p 29-31 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21654#** Joint Publications Research Service, Arlington, Va.
**MECHANIZATION OF ASSEMBLY AND WELDING OPERATIONS IN MANUFACTURE OF SHIP HULL STRUCTURES Abstract Only**
V. D. Veselkov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 38 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 10, Oct. 1983 p 27-29 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21655#** Joint Publications Research Service, Arlington, Va.
**INTRODUCTION OF PRODUCTIVE WELDING AND SURFACING TECHNOLOGICAL PROCESSES TO PRODUCTION OF NUCLEAR POWERPLANT EQUIPMENT Abstract Only**
Yu. F. Uglov, I. F. Trofimov, A. A. Khodosevich, M. P. Yun, G. M. Bayrakovskiy, and A. S. Yevtushenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 39 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 10, Oct. 1983 p 20-22 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21656#** Joint Publications Research Service, Arlington, Va.
**CERTAIN FEATURES OF A VACUUM MAGNETIC-IMPULSE WELDING PROCESS Abstract Only**
Ye. L. Strizhakov, M. Kh. Shorshorov, A. I. Asotov, and A. M. Loktionov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 39-40 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (Moscow), no. 5, Sep. - Oct. 1983 p 104-108 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

# 38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

**N84-21889#** Aeronautical Research Labs., Melbourne (Australia).
**ON THE GENESIS OF RELIABILITY MODELS**
G. D. Mallinson Jul. 1982 57 p refs
(ARL-STRUC-REPT-393; AR-002-896) Avail: NTIS HC A04/MF A01

A method for the derivation of reliability models for fatigue is presented and its application demonstrated. Author

**N84-21890#** Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
**RELIABILITY ANALYSIS OF MULTI-COMPONENTS SYSTEMS**
Michael F. Millea 15 Dec. 1983 44 p
(Contract F04701-83-C-0084)
(AD-A138013; TR-0084(4925-02)-1; SD-TR-83-85) Avail: NTIS HC A03/MF A01 CSCL 14/4

The reliability of systems consisting of many semiconductor devices is estimated from the results of an accelerated temperature aging test program. This work is an extension of our previous analysis of accelerated aging, in which we assumed that the results from a Student-t analysis can be applied directly to a multi-component amplifier in the classical combinatory manner. In this work we no longer make this assumption but employ a computer simulation to obtain a more efficient estimation of the reliability of an amplifier consisting of many semiconductor devices.
Author (GRA)

**N84-21891#** Los Alamos Scientific Lab., N. Mex.
**STATE VARIABLE METHOD OF FAULT TREE ANALYSIS**
Robert J. Bartholomew, Harold K. Knudsen (New Mexico Univ.), and Glenn A. Whan (New Mexico Univ.) 1984 28 p refs Presented at the Symp. on Space Nucl. Power Systems, Albuquerque, N. Mex., 10-12 Jan. 1984
(Contract W-7405-eng-36)
(DE84-006007; LA-UR-84-53; CONF-840113-5) Avail: NTIS HC A03/MF A01

The current technique of Fault Tree Analysis (FTA) generally employs computer codes that calculate the minimal cut sets of the Boolean function, where each cut set comprises basic initiator events (roots) whose intersection implies the occurrence of a TOP (system failure) event. Because the number of calculations is very large for typical fault trees, the importance of any given cut set is assessed by qualitative algorithms that includes the number of basic events in the cut set, and quantitative importance algorithms that involve probabilistic upper and lower bound estimates, and the sets are culled before quantitative probability calculations are made. The question addressed in this paper is: can a tractable mathematical model be found that performs quantitative calculations without the need of upper or lower bound simplications and include within its structure the capability of handling common cause/common mode statistical dependence, failure mode coupling interdependence, and sequential failure time dependence. DOE

**N84-21892#** Mound Lab., Miamisburg, Ohio.
**ULTRASONIC INSPECTION OF MC2893 STRENGTH MEMBER ASSEMBLY WELD**
W. A. Dudley 17 Feb. 1984 11 p
(Contract DE-AC04-76DP-00053)
(DE84-007084; MLM-MU-84-62-0001) Avail: NTIS HC A02/MF A01

An ultrasonic technique developed to nondestructively inspect an assembly weld critical to the fabrication and production of MC2893 heat sources is described. Prior to transferring the assembly technology to Los Alamos National Laboratory, the ultrasonic technique was used as a 100% inline inspection tool.
DOE

**N84-21893#** Technische Hogeschool, Delft (Netherlands). Afdeling der Luchtvaart en Ruimtevaart Techniek.
**NONDESTRUCTIVE ULTRASONIC INVESTIGATION OF MODERN FIBER REINFORCED COMPOSITES [NIET DESTRUCTIEF ULTRASOON ONDERZOEK AAN MODERNE VEZELVERSTERKTE KUNNSTSTOFFEN]**

W. H. M. vanDreumel Apr. 1983 15 p In DUTCH
(VTH-LR-382) Avail: NTIS HC A02/MF A01

Ultrasonic nondestructive investigation methods for fiber reinforced composites are reviewed. The scan method gives ambiguous quantitative information, but it provides a usable qualitative impression of the direction dependent elasticity modulus since it recognizes the characteristic patterns of laminates. A method which uses signal reflection, transmitter and receiver being at the same side of the investigated material, is described. Signal processing techniques, data storage, and image processing with pattern recognition methods are mentioned. Author (ESA)

**N84-21894#** Siemens A.G., Munich (West Germany). Components Group.
**RELIABILITY ASSURANCE USING TEST STRUCTURES, PHASE 2 Final Report**
W. Gerling and E. Sussmann Paris ESA May 1982 360 p 2 Vol.
(Contract ESTEC-2565/75/HP(SC))
(ESA-CR(P)-1827-Vol-1) Avail: NTIS HC A16/MF A01

Characterization of failure mechanisms of MOS integrated circuits by observable effects during stress tests is described. Electronic properties and dielectric strength of oxides were determined. Gate protection; surface ion migration; capacitance and leakage of diffused structures; aluminum migration; and contact reliability were studied. Effective gain factor and channel drift mobility by RON-structures; field oxide inversion and punch through; and stability of load MOSTs and inverters were investigated. Sheet resistance; contact resistance, crystal defects; and mechanical strains were examined. Author (ESA)

**N84-21895#** Siemens A.G., Munich (West Germany). Components Group.
**RELIABILITY ASSURANCE USING TEST STRUCTURES, PHASE 3 Final Report**
W. Gerling Paris ESA Jul. 1982 88 p refs 2 Vol.
(Contract ESTEC-2565/75/HP(SC))
(ESA-CR(P)-1827-Vol-2) Avail: NTIS HC A05/MF A01

The feasibility of representing MOS circuit reliability properties by test structures is considered. The application of test structures for reliability evaluation and in-process reliability assurance is reviewed. Possibilities of implementing test structures in manufacturing are discussed. Accelerations models, failure mechanism stress dependence, and defect modes are summarized. Reliability assurance using test structures is outlined and test procedures corresponding to the different reliability aspects are described. Parts of the available test structures are suggested for in-process control. Author (ESA)

# 39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

**N84-21896#** British Library Lending Div., Boston Spa (England).
**INFLUENCE OF TRANSIENT REGIMES OF THE MOTOR ON ELASTIC MECHANICAL VIBRATIONS IN AN ELECTRIC DRIVE**
A. N. Popov and I. V. Frantsenyuk 31 Jan. 1984 10 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chernaya Met. (USSR), v. 5, 1983 p 134-138
(BLL-M-35438-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

Mechanical vibrations in an elastic mechanical component of a two mass mechanical system without gaps that arise during control of the electric motor are considered. It is shown that these vibrations are a consequence of electrical oscillations of the motor current due to the presence of inductance in the armature circuit. During disturbances on the motor side not connected with mechanical impact, the maximal relative deviations of torque vibrations in an elastic mechanical element do not reach 30%. Author

**N84-21897** National Physical Lab., Teddington (England). Div. of Materials Applications.
**A THEORETICAL ANALYSIS OF THE INFLUENCE OF CRACK DIMENSIONS AND GEOMETRY ON MASS TRANSPORT IN CORROSION FATIGUE CRACKS**
A. Turnbull Jul. 1983 40 p refs
(NPL-DMA(A)-69; ISSN-0143-7313) Copyright. Avail: Issuing Activity

Theoretical models based on cathodic reduction of oxygen on the crack walls, and anodic dissolution of metal at the crack tip were developed to describe the concentration of dissolved species in a corrosion fatigue crack. The concentration of species in a trapezoidal-shaped crack was calculated over a range of crack depths from 0.0254 to 2 cm for different values of minimum load/maximum load, stress intensity factor and frequency. The importance of diffusion and fluid flow as a function of these parameters was analyzed. The influence of specimen geometry on the solution composition was determined and the use of equivalent parallel-sided cracks is discussed. Implications for corrosion fatigue crack growth are assessed. Author (ESA)

**N84-21898** Ruhr Univ.; Bochum (West Germany). Inst. fuer Mechanik.
**METHODICAL LAYOUT OF MECHANICAL SYSTEMS WITH REGARD TO OPTIMUM VIBRATIONAL BEHAVIOR Thesis [ZUM METHODISCHEN ENTWURF MECHANISCHER SYSTEME IN HINBLICK AUF OPTIMALES SCHWINGUNGSVERHALTEN]**
Alfred Kraft Jul. 1983 204 p refs In GERMAN; ENGLISH summary
(Rept-36) Copyright. Avail: Issuing Activity

Electrical network synthesis methods are worked out for mechanics. Positive-real functions and matrices were used to describe passive mechanical systems. The free parameters of such functions and matrices were used for the optimization of vibration absorbers. A mechanical network was obtained, the mass of which was bound by an inertial system. By applying the synthesis methods, nonlinked network masses were obtained. With beam systems the mechanical realization is possible. It is proved that all positive-real functions can be realized by passive mechanical systems. Author (ESA)

**N84-21899*#** National Aeronautics and Space Administration, Washington, D. C.
**THE NASTRAN USER'S MANUAL**
Sep. 1983 1626 p
(NASA-SP-222(06); NAS 1.12/6:222(06)) Avail: NTIS HC A99/MF A01 CSCL 20K

All information directly associated with problem solving using the NASTRAN program is presented. This structural analysis program uses the finite element approach to structural modeling wherein the distributed finite properties of a structure are represented by a finite element of structural elements which are interconnected at a finite number of grid points, to which loads are applied and for which displacements are calculated. Procedures are described for defining and loading a structural model. Functional references for every card used for structural modeling, the NASTRAN data deck and control cards, problem solution sequences (rigid formats), using the plotting capability, writing a direct matrix abstraction program, and diagnostic messages are explained. A dictionary of mnemonics, acronyms, phrases, and other commonly used NASTRAN terms is included. A.R.H.

**N84-21900*#** Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Composite Materials and Structures.
**CONTACT STRESSES IN PIN-LOADED ORTHOTROPIC PLATES**
M. W. Hyer and E. C. Klang Apr. 1984 55 p refs
(NASA-CR-173475; NAS 1.26:173475; CCMS-84-02; VPI-E-84-14)
Avail: NTIS HC A04/MF A01 CSCL 20K

The effects of pin elasticity, friction, and clearance on the stresses near the hole in a pin-loaded orthotropic plate are described. The problem is modeled as a contact elasticity problem using complex variable theory, the pin and the plate being two elastic bodies interacting through contact. This modeling is in contrast to previous works which assumed that the pin is rigid or that it exerts a known cosinusoidal radial traction on the hole boundary. Neither of these approaches explicitly involves a pin. A collocation procedure and iteration were used to obtain numerical results for a variety of plate and pin elastic properties and various levels of friction and clearance. Collocation was used to enforce the boundary and iteration was used to find the contact and no-slip regions on the boundary. Details of the numerical scheme are discussed. Author

**N84-21901*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SURVEY OF NASA RESEARCH ON CRASH DYNAMICS**
Robert G. Thomson, Huey D. Carden, and Robert J. Hayduk Apr. 1984 46 p refs
(NASA-TP-2298; L-15757; NAS 1.60:2298) Avail: NTIS HC A03/MF A01 CSCL 20K

Ten years of structural crash dynamics research activities conducted on general aviation aircraft by the National Aeronautics and Space Administration (NASA) are described. Thirty-two full-scale crash tests were performed at Langley Research Center, and pertinent data on airframe and seat behavior were obtained. Concurrent with the experimental program, analytical methods were developed to help predict structural behavior during impact. The effects of flight parameters at impact on cabin deceleration pulses at the seat/occupant interface, experimental and analytical correlation of data on load-limiting subfloor and seat configurations, airplane section test results for computer modeling validation, and data from emergency-locator-transmitter (ELT) investigations to determine probable cause of false alarms and nonactivations are assessed. Computer programs which provide designers with analytical methods for predicting accelerations, velocities, and displacements of collapsing structures are also discussed. Author

**N84-21902*#** Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
**SIMULTANEOUS ANALYSIS AND DESIGN**
Raphael T. Haftka Hampton, Va. NASA. Langley Research Center Apr. 1984 25 p refs
(Grant NAG1-168)
(NASA-CR-172334; NAS 1.26:172334) Avail: NTIS HC A02/MF A01 CSCL 20K

Optimization techniques are increasingly being used for performing nonlinear structural analysis. The development of element by element (EBE) preconditioned conjugate gradient (CG) techniques is expected to extend this trend to linear analysis. Under these circumstances the structural design problem can be viewed as a nested optimization problem. There are computational benefits to treating this nested problem as a large single optimization problem. The response variables (such as displacements) and the structural parameters are all treated as design variables in a unified formulation which performs simultaneously the design and analysis. Two examples are used for demonstration. A seventy-two bar truss is optimized subject to linear stress constraints and a wing box structure is optimized subject to nonlinear collapse constraints. Both examples show substantial computational savings with the unified approach as compared to the traditional nested approach. Author

**N84-21903*#** Toledo Univ., Ohio. Dept. of Civil Engineering.
**THERMAL STRESS ANALYSIS FOR A WOOD COMPOSITE BLADE Report, 5 Dec. 1982 - 4 Apr. 1984**
Kuan-Chen Fu and Awad Harb 4 Apr. 1984 117 p refs
(Grant NAG3-373)
(NASA-CR-173394; NAS 1.26:173394) Avail: NTIS HC A06/MF A01 CSCL 20K

Heat conduction throughout the blade and the distribution of thermal stresses caused by the temperature distribution were determined for a laminated wood wind turbine blade in both the horizontal and vertical positions. Results show that blade cracking is not due to thermal stresses induced by insulation. A method and practical example of thermal stress analysis for an engineering body of orthotropic materials is presented. A.R.H.

**N84-21904*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**HYGROTHERMAL INFLUENCE ON DELAMINATION BEHAVIOR OF GRAPHITE/EPOXY LAMINATES**
Amar Garg and Ori Ishai Mar. 1984 46 p refs
(NASA-TM-85935; A-9705; NAS 1.15:85935) Avail: NTIS HC A03/MF A01 CSCL 20K

The hygrothermal effect on the fracture behavior of graphite-epoxy laminates was investigated to develop a methodology for damage tolerance predictions in advanced composite materials. Several T300/934 laminates were tested using a number of specimen configurations to evaluate the effects of temperature and humidity on delamination fracture toughness under mode 1 and mode 2 loading. It is indicated that moisture has a slightly beneficial influence on fracture toughness or critical strain energy release rate during mode 1 delamination, but has a slightly deleterious effect on mode 2 delamination and mode 1 transverse cracking. The failed specimens are examined by SEM and topographical differences due to fracture modes are identified. It is concluded that the effect of moisture on fracture topography can not be distinguished. E.A.K.

**N84-21905*#** Connecticut Univ., Storrs. Dept. of Mechanical Engineering.
**ELEVATED TEMPERATURE BIAXIAL FATIGUE Semiannual Status Report, 15 Feb. - 15 Aug. 1983**
Eric H. Jordan 15 Aug. 1983 21 p
(Grant NAG3-160)
(NASA-CR-173473; NAS 1.26:173473) Avail: NTIS HC A02/MF A01 CSCL 20K

Biaxial fatigue is often encountered in the complex thermo-mechanical loadings present in gas turbine engines. Engine strain histories can involve non-constant temperature, mean stress, creep, environmental effects, both isotropic and anisotropic materials and non-proportional loading. Life prediction for the general case involving all the above factors is not a practicable research project. The current research program is limited to isothermal fatigue at room temperature and 1200 F of Hastalloy-X for both proportional and non-proportional loading. An improved method for predicting the fatigue life and deformation response under biaxial cycle loading is sought. Author

**N84-21906#** Illinois Univ., Chicago. Dept. of Civil Engineering Mechanics and Metallurgy.
**SHOCK WAVES IN 3-DIMENSIONAL ELASTIC SOLIDS Final Report, 15 Mar. 1980 - 14 Oct. 1983**
T. C. T. Ting 9 Jan. 1984 7 p
(Contract DAAG29-80-C-0093)
(AD-A138018; ARO-17055.8-EG) Avail: NTIS HC A02/MF A01 CSCL 20/11

The purpose of this research was to study some aspects of shock waves in three dimensional elastic solids. In particular, the transport equations are to be derived for the growth or decay of a three dimensional shock wave. This report summarizes the results obtained from this investigation. GRA

**N84-21907#** Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
**PLASTIC DEFORMATIONS NEAR A RAPIDLY PROPAGATING CRACK TIP Interim Report**
J. D. Achenback and Z. L. Li Jan. 1984 47 p
(Contract N00014-76-C-0063)
(AD-A138273; AD-E950472; NU-SML-TR-84-1) Avail: NTIS HC A03/MF A01 CSCL 20/12

For rapid crack propagation in an elastic perfectly-plastic material, explicit expressions have been obtained for the dynamic strains on the crack line, from the moving crack tip to the moving

elastic-plastic boundary. The method of solution uses power series in the distance to the crack line, with coefficients which depends on the distance to the crack tip. Substitution of the expansions in the equations of motion, the yield condition (Huber-Mises) and the stress-strain relation, yields a system of nonlinear ordinary different equations for the coefficients. These equations are exactly solvable for Mode-III, and they have been solved in an approximate manner for Mode-I plane stress. The crack-line fields have been matched to appropriate elastic fields at the elastic-plastic boundary. For both Mode-III and Mode-I plane stress, the plastic strains, which depend on the elastodynamic stress intensity factor and the crack-tip speed, have been used in conjunction with the crack growth criterion of critical plastic strain, to determine the relation between the far-field stress level and the crack-tip speed.

Author (GRA)

**N84-21908#** California Univ., Livermore. Lawrence Livermore Lab.

**FINITE DEFORMATION OF VISCOELASTIC DISKS**

William W. Feng Jan. 1983 5 p refs Presented at the ASCE Eng. Mech. Div. Spec. Conf., Lafayette, Ind., 23-25 May 1983

(Contract W-7405-eng-48)

(DE84-002795; UCRL-88637; CONF-830510-2) Avail: NTIS HC A02/MF A01

The formulation for the finite elastic deformation of a circular disks of various thickness under rotation is extended to finite deformation viscoelastic problems using the viscoelastic constitutive equations. When the relaxation function follows the exponential law, the hereditary integrals can be written in incremental forms, and a recurrent formula is obtained. The principal stretch ratios in the radial and tangential directions are used as dependent variables. The governing equations for these variables are reduced to two coupled first-order ordinary differential-integral equations with explicit derivatives. DOE

**N84-21909#** National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

**STRUCTURAL DEFORMATION: A COMPREHENSIVE SURVEY OF MODERN MEASUREMENT METHODS**

P. J. Sevenhuijsen Mar. 1982 117 p refs In DUTCH; ENGLISH summary

(Contract NIVR-1855)

(NLR-TR-82021-U) Avail: NTIS HC A06/MF A01

Structural deformation measurement methods are surveyed, and aspects of light physics which are vital for the understanding of optical methods are treated. Methods based on strain gages, stress gages, photoelastic coatings, grids, lasers, Moire interferometry, picture correlation, caustics, speckles and holographic interferometry are described. Physical principles, applicability, handling, instrumentation, accuracy, speed and costs are discussed. Author (ESA)

**N84-21910#** Oxford Univ. (England). Dept. of Engineering Science.

**STRESSES ROUND A CIRCULAR HOLE IN A UNIFORM PLATE SUBJECT TO HYDROSTATIC COMPRESSION, UNDER VARIOUS CONDITIONS OF SUPPORT, IN PLANE STRESS AND PLANE STRAIN**

E. Lightfoot 1983 11 p refs Sponsored by the UK Ministry of Defence

(OUEL-1497/83) Avail: NTIS HC A02/MF A01

Loads on a flexible circular pipe buried deep in the ground are analyzed. The elastic stresses round a disk supported and a ring supported circular hole in an elastic plate under hydrostatic pressure are investigated, for plane stress and plane strain conditions. The pressure developed on the disk and on the ring is considered in terms of the applied hydrostatic pressure. Two figures enable this pressure to be easily found for the case when Poisson's ratio for the plate is taken as 0.5 (as for plastic earth) and for 0.20 (as for medium grained dense sand). Author (ESA)

**N84-21911#** Instituut TNO voor Werktuigkundige Constructies, Delft (Netherlands).

**OPTIMIZATION OF A STIFFENED PLATE**

R. A. P. J. Schulze and R. Regoord Dec. 1982 41 p refs In DUTCH; ENGLISH summary Presented at 'Algemene Voorwaarden voor Onderzoeks- en Ontwikkelingsopdrachtenaan TNO', the Hague, 1979

(Contract A82/KM/030)

(IWECO-5071303-82-1; TDCK-77818) Avail: NTIS HC A03/MF A01

The cost of a stiffened plate was optimized using the computer program OPTIMA and rules of thumb. The most important subroutines are enclosed. Boundary conditions are the local and global buckling loads. Design variables are the number of stiffeners, the plate thickness, and the dimensions of the stiffeners. Optimal geometries are determined for several configurations.

Author (ESA)

**N84-21912#** Instituut TNO voor Werktuigkundige Constructies, Delft (Netherlands).

**INVESTIGATION OF THE STRENGTH OF A FLYCATCHER WHEEL SUSPENSION [STERKTE-ONDERZOEK AAN FLYCATCHER-WIELOPHANGING]**

R. A. P. J. Schulze and F. Roode Mar. 1983 13 p In DUTCH; ENGLISH summary Presented at 'Algemene Voorwaarden voor Onderzoeks- en Ontwikkelingsopdrachtenaan TNO', the Hague, 1979

(Contract A/KLu/019)

(IWECO-5075410-83-01; TDCK-77819) Avail: NTIS HC A02/MF A01

The strength of a supporting arm of the wheel suspension of the Flycatcher transporting frame was assessed. Two supporting arms were tested and a stress-strain diagram was determined. The strain was measured at places where maximum stress was expected, using strain gages. Both arms broke at a force of 65 kN. The maximum strain is 4000 microR. A modification of the construction for symmetric load distribution shows an improvement of 30%. Author (ESA)

**N84-21913#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

**AN ASSESSMENT OF THE STATIC STRENGTH OF FLUSH HEAD ALUMINUM ALLOY RIVETS IN TWO GRADES OF ARAMID ALUMINIUM LAMINATE (ARALL) SHEET**

J. W. Gunnink and A. Rothwell Jul. 1983 21 p refs

(VTH-LR-391) Avail: NTIS HC A02/MF A01

Aluminum alloy sheet rivet data were assessed to see if any loss of strength is likely for rivets made of Aramid Aluminum Laminate (ARALL). Tests on 4.8 mm diameter 2024-T3 flush head rivets in 1.0 and 2.2 mm thick 2024-T3 ARALL sheet (t/D = 0.21 and 0.46, respectively) suggest that there is no reduction in ultimate strength, but the results also suggest a significant reduction in yield strength (of the order of 15%). This appears to be caused by severe bending deformation in the sheet around the rivet, and may be aggravated by the nature of the laminated material.

Author (ESA)

**N84-21914#** Technische Univ., Hanover (West Germany). Inst. fuer Statik.

**GEOMETRICALLY NONLINEAR ANALYSIS OF BEAM-IN-SPACE STRUCTURES Thesis**

G. Lumpe 15 Dec. 1982 107 p refs In GERMAN; ENGLISH summary

(Mitt-28; ISSN-0073-0300) Avail: NTIS HC A06/MF A01

A finite element concept for complex beam-in-space structures based on large displacement and small strain theory is developed. Derivation of a beam theory from the three dimensional theory with consistent approaches and error estimations combined with separation of rigid body motion and actual deformation allowed the derivation of a simple tangent stiffness matrix which takes into account geometrically nonlinear effects. The magnitude of error is a function of element length. The rotation of each cross section is described by an orthogonal tensor as a rotation about one skew axis to avoid nonsymmetric stiffness matrices. The range of application includes hinge fitting combination, shear deformation,

and hindered torsion. For cable-roll-connections, a simple algorithm which overcomes the difficult kinematic relations of cable rolls by energetical considerations is presented. Efficiency of the computation method is demonstrated by the example of a tower crane.
Author (ESA)

**N84-21661#** Joint Publications Research Service, Arlington, Va.
**ANALYSIS OF UNSTEADY PROCESSES CAUSED BY NONAXISYMMETRICAL LOADING OF FINITE MULTILAYER CYLINDERS**
Z. G. Alpaidze, Yu. N. Babich, and Sh. U. Galiyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 44-45 refs Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 9, Sep. 1983 p 3-7 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

# 42 GEOSCIENCES (GENERAL)

**N84-21915*#** Technicolor Government Services, Inc., Moffett Field, Calif.
**AN EVALUATION OF THEMATIC MAPPER SIMULATOR DATA FOR THE GEOBOTANICAL DISCRIMINATION OF ROCK TYPES IN SOUTHWEST OREGON**
K. J. Weinstock and L. A. Morrissey Jan. 1984 63 p refs Original contains color illustrations
(Contract NAS2-11101)
(NASA-CR-166569; NAS 1.26:166569) Avail: NTIS HC A04/MF A01 CSCL 08B

Rock type identification may be assisted by the use of remote sensing of associated vegetation, particularly in areas of dense vegetative cover where surface materials are not imaged directly by the sensor. The geobotanical discrimination of ultramafic parent materials was investigated and analytical techniques for lithologic mapping and mineral exploration were developed. The utility of remotely sensed data to discriminate vegetation types associated with ultramafic parent materials in a study area in southwest Oregon were evaluated. A number of specific objectives were identified, which include: (1) establishment of the association between vegetation and rock types; (2) examination of the spectral separability of vegetation types associated with rock types; (3) determination of the contribution of each TMS band for discriminating vegetation associated with rock types and (4) comparison of analytical techniques for spectrally classifying vegetation. E.A.K.

**N84-21916#** California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
**[RESEARCH HIGHLIGHTS FROM THE EARTH SCIENCES DIVISION] Annual Report, 1982**
Sep. 1983 289 p refs
(Contract DE-AC03-76SF-00098)
(DE84-003916; LBL-15500) Avail: NTIS HC A13/MF A01

Separate abstracts were prepared for individual reports. The categories covered include: geophysics; geomechanics; geochemistry; reservoir engineering; hydrogeology; Mexican-American cooperative program, Cerro Prieto, and Site Characterization Strategies for nuclear waste disposal in basalt. DOE

# 43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

**N84-21917*#** Michigan State Univ., East Lansing. Center for Remote Sensing.
**INTERPRETING MICHIGAN FOREST COVER TYPES FROM COLOR INFRARED AERIAL PHOTOGRAPHS**
William D. Hudson Jan. 1984 28 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-23-004-083)
(E84-10097; NASA-CR-173346; NAS 1.26:173346) Avail: NTIS HC A03/MF A01 CSCL 02F

The characteristics of 17 cover types (13 forest types or tree species and 4 nonforest cover types) in Michigan are discussed as well as their interpretation from medium scale color infrared photography. The occurrence of each type is described by region and site requirements. Those attributes of a tree or stand which are helpful when attempting to interpret the type from a vertical perspective are discussed as well as common crown types. The identification of the forest type or tree species by using image characteristics (size, shape, shadow, color, texture, pattern, or association) is discussed. Ground photographs and sketches of individual trees are included. Stereograms of typical stands are available. A.R.H.

**N84-21918*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PERFORMANCE EVALUATION AND GEOLOGIC UTILITY OF LANDSAT-4 TM AND MSS DATA Quarterly Report, Dec. 1983 - Mar. 1984**
Earnest D. Paylor Mar. 1984 10 p ERTS
(Contract NAS7-918)
(E84-10099; NASA-CR-173368; NAS 1.26:173368) Avail: NTIS HC A02/MF A01 CSCL 08G

Radiometric calibration accuracy of TM data, radiometric comparison of A-, B-, and P-format data, and geometric registration accuracy of the TM data at enlarged scales were analyzed. Radiometric analysis of the Wind River Basin, Wyoming scene demonstrates that the TM system can be used to extract image reflectance spectra from ground targets following calibration of the system. It was also demonstrated that: (1) image DN (radiance values) vs. ground reflectance calibration scatterplots yield parameters which can be used to constrain atmospheric models and can determine TM radiometric sensitivity; (2) no significant degradation occurs as a result of radiometric and geometric correction by SCROUNGE processing; and (3) TM data can be enlarged to 1:24000 with no major geometric distortions or misregistration problems to USGS topographic maps. M.G.

**N84-21919*#** National Oceanic and Atmospheric Administration, Columbia, Mo.
**ARGENTINA WHEAT YIELD MODEL**
Susan L. Callis and Clarence Sakamoto 16 Jan. 1984 38 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E84-10101; NASA-CR-173370; YM-N4-04457; JSC-18909; NAS 1.26:173370) Avail: NTIS HC A03/MF A01 CSCL 02C

Five models based on multiple regression were developed to estimate wheat yields for the five wheat growing provinces of Argentina. Meteorological data sets were obtained for each province by averaging data for stations within each province. Predictor variables for the models were derived from monthly total precipitation, average monthly mean temperature, and average monthly maximum temperature. Buenos Aires was the only province for which a trend variable was included because of increasing trend in yield due to technology from 1950 to 1963.
M.G.

**N84-21920*#** National Oceanic and Atmospheric Administration, Columbia, Mo.
**ARGENTINA SOYBEAN YIELD MODEL**
Susan L. Callis and Clarence Sakamoto 16 Jan. 1984 15 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E84-10102; NASA-CR-173371; YM-N4-04453; JSC-18905; NAS

1.26:173371) Avail: NTIS HC A02/MF A01 CSCL 02C

A model based on multiple regression was developed to estimate soybean yields for the country of Argentina. A meteorological data set was obtained for the country by averaging data for stations within the soybean growing area. Predictor variables for the model were derived from monthly total precipitation and monthly average temperature. A trend variable was included for the years 1969 to 1978 since an increasing trend in yields due to technology was observed between these years. M.G.

**N84-21921*#** National Oceanic and Atmospheric Administration, Columbia, Mo.

**BRAZIL WHEAT YIELD COVARIANCE MODEL**

Susan L. Callis and Clarence Sakamoto 16 Jan. 1984 22 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Proj. AgRISTARS)

(E84-10103; NASA-CR-173372; YM-N4-04454; JSC-18906; NAS 1.26:173372) Avail: NTIS HC A02/MF A01 CSCL 02C

A model based on multiple regression was developed to estimate wheat yields for the wheat growing states of Rio Grande do Sul, Parana, and Santa Catarina in Brazil. The meteorological data of these three states were pooled and the years 1972 to 1979 were used to develop the model since there was no technological trend in the yields during these years. Predictor variables were derived from monthly total precipitation, average monthly mean temperature, and average monthly maximum temperature. M.G.

**N84-21922*#** National Oceanic and Atmospheric Administration, Columbia, Mo.

**BRAZIL SOYBEAN YIELD COVARIANCE MODEL**

Susan L. Callis and Clarence Sakamoto 16 Jan. 1984 25 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Proj. AgRISTARS)

(E84-10104; NASA-CR-173373; YM-N4-04455; JSC-18907; NAS 1.26:173373) Avail: NTIS HC A02/MF A01 CSCL 02C

A model based on multiple regression was developed to estimate soybean yields for the seven soybean-growing states of Brazil. The meteorological data of these seven states were pooled and the years 1975 to 1980 were used to model since there was no technological trend in the yields during these years. Predictor variables were derived from monthly total precipitation and monthly average temperature. M.G.

**N84-21923*#** National Oceanic and Atmospheric Administration, Columbia, Mo.

**ARGENTINA CORN YIELD MODEL**

Susan L. Callis and Clarence Sakamoto 16 Jan. 1984 15 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Proj. AgRISTARS)

(E84-10105; NASA-CR-173374; YM-N4-04456; JSC-18908; NAS 1.26:173374) Avail: NTIS HC A02/MF A01 CSCL 02C

A model based on multiple regression was developed to estimate corn yields for the country of Argentina. A meteorological data set was obtained for the country by averaging data for stations within the corn-growing area. Predictor variables for the model were derived from monthly total precipitation, average monthly mean temperature, and average monthly maximum temperature. A trend variable was included for the years 1965 to 1980 since an increasing trend in yields due to technology was observed between these years. M.G.

**N84-21924*#** California Univ., Berkeley. Space Sciences Lab.

**ANALYSIS OF THE QUALITY OF IMAGE DATA ACQUIRED BY THE LANDSAT-4 THEMATIC MAPPER AND MULTISPECTRAL SCANNERS Quarterly Status Technical Progress Report, 1 Oct. - 31 Dec. 1983**

Robert N. Colwell, Principal Investigator 15 Jan. 1984 25 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (Contract NAS5-17377)

(E84-10106; NASA-CR-173375; NAS 1.26:173375; QSTPR-4) Avail: NTIS HC A02/MF A01 CSCL 05B

A seven step procedure developed for evaluating the geometric properties of MSS and TM film produces is being implemented. Some 476 control points were selected of which 238 are being tested and edited for digitization and scaling errors. Tables show statistics established for assessing the spectral characteristics and variability, as well as the spatial resolution and radiometric sensitivity of TM data for a forest environment in an effort to determine the extent to which major forest cover type can be detected and identified on TM digital and image products. Results thus far show that the high quality obtained are more than sufficient for meeting most of the inventory objectives of the renewable resource specialist. The TM data should be extremely valuable for: (1) estimating forest cover types; (2) updating land use survey maps; and (3) determining the size and shape and location of individual forest clearings and water resources. A.R.H.

**N84-21925*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**REMOTE SENSING OF AGRICULTURAL CROPS AND SOILS Final Report**

Marvin E. Bauer, Principal Investigator Feb. 1983 173 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (Contract NAS9-16528; Proj. AgRISTARS)

(E84-10107; NASA-CR-171768; SR-P3-04399; NAS 1.26:171768; LARS-022183) Avail: NTIS HC A08/MF A01 CSCL 02C

Research in the correlative and noncorrelative approaches to image registration and the spectral estimation of corn canopy phytomass and water content is reported. Scene radiation research results discussed include: corn and soybean LANDSAT MSS classification performance as a function of scene characteristics; estimating crop development stages from MSS data; the interception of photosynthetically active radiation in corn and soybean canopies; costs of measuring leaf area index of corn; LANDSAT spectral inputs to crop models including the use of the greenness index to assess crop stress and the evaluation of MSS data for estimating corn and soybean development stages; field research experiment design data acquisition and preprocessing; and Sun-view angles studies of corn and soybean canopies in support of vegetation canopy reflection modeling. A.R.H.

**N84-21926*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

**EVALUATION OF A NATIVE VEGETATION MASKING TECHNIQUE**

Margaret C. Kinsler Feb. 1984 30 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS)

(E84-10108; NASA-CR-171767; EW-L4-04452; JSC-18903; NAS 1.26:171767; LEMSCO-20206) Avail: NTIS HC A03/MF A01 CSCL 02C

A crop masking technique based on Ashburn's vegetative index (AVI) was used to evaluate native vegetation as an indicator of crop moisture condition. A mask of the range areas (native vegetation) was generated for each of thirteen Great Plains LANDSAT MSS sample segments. These masks were compared to the digitized ground truth and accuracies were computed. An analysis of the types of errors indicates a consistency in errors among the segments. The mask represents a simple quick-look technique for evaluating vegetative cover. A.R.H.

**N84-21927*#** Kansas State Univ., Manhattan. Dept. of Agronomy.

**INTERCEPTED PHOTOSYNTHETICALLY ACTIVE RADIATION ESTIMATED BY SPECTRAL REFLECTANCE**

J. L. Hatfield, G. Asrar, and E. T. Kanemasu Sep. 1982 28 p

refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS9-16457; Proj. AgRISTARS)
(E84-10109; NASA-CR-171758; SR-M2-04342; NAS 1.26:171758; Contrib-82-559-J) Avail: NTIS HC A03/MF A01 CSCL 02C

The interception of photosynthetically active radiation (PAR) was evaluated relative to greenness and normalized difference (MSS 7-5/7+5) for five planting dates of wheat for 1978-79 and 1979-80 in Phoenix. Intercepted PAR was calculated from a model driven by leaf area index and stage of growth. Linear relationships were found between greenness and normalized difference with a separate model representing growth and senescence of the crop. Normalized difference was a significantly better model and would be easier to apply than the empirically derived greenness parameter. For the leaf area growth portion of the season the model between PAR interception and normalized difference was the same over years, however, for the leaf senescence the models showed more variability due to the lack of data on measured interception in sparse canopies. Normalized difference could be used to estimate PAR interception directly for crop growth models. Author

**N84-21928*#** Columbia Univ., New York. Lab. of Applied Geophysics.
**DETECTION OF HIDDEN MINERAL DEPOSITS BY AIRBORNE SPECTRAL ANALYSIS OF FOREST CANOPIES Final Report**
William Collins, Sheng-Huei Chang, and John T. Kuo [1984] 79 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grants NsG-5222; NSF DAR-78-16320)
(E84-10110; NASA-CR-175210; NAS 1.26:175210) Avail: NTIS HC A05/MF A01 CSCL 02F

Data from field surveys and biogeochemical tests conducted in Maine, Montana, and Washington strongly correlate with results obtained using high resolution airborne spectroradiometer which detects an anomalous spectral waveform that appears definitely associated with sulfide mineralization. The spectral region most affected by mineral stress is between 550 nm and 750 nm. Spectral variations observed in the field occur on the wings of the red chlorophyll band centered at about 690 nm. The metal-stress-induced variations on the absorption band wing are most successfully resolved in the high spectral resolution field data using a waveform analysis technique. The development of chlorophyll pigments was retarded in greenhouse plants doped with copper and zinc in the laboratory. The lowered chlorophyll production resulted in changes on the wings of the chlorophyll bands of reflectance spectra of the plants. The airborne spectroradiometer system and waveform analysis remains the most sensitive technique for biogeochemical surveys. A.R.H.

**N84-21929*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**FUNDAMENTAL REMOTE SENSING SCIENCE RESEARCH PROGRAM. PART 1: SCENE RADIATION AND ATMOSPHERIC EFFECTS CHARACTERIZATION PROJECT Status Report**
R. E. Murphy and D. W. Deering Mar. 1984 259 p refs
(NASA-TM-86078; NAS 1.15:86078) Avail: NTIS HC A12/MF A01 CSCL 05B

Brief articles summarizing the status of research in the scene radiation and atmospheric effect characterization (SRAEC) project are presented. Research conducted within the SRAEC program is focused on the development of empirical characterizations and mathematical process models which relate the electromagnetic energy reflected or emitted from a scene to the biophysical parameters of interest. For individual titles, see N84-21930 through N84-21954.

**N84-21930*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**NASA FUNDAMENTAL REMOTE SENSING SCIENCE RESEARCH PROGRAM**
*In its* Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 2-29 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 05B

The NASA Fundamental Remote Sensing Research Program is described. The program provides a dynamic scientific base which is continually broadened and from which future applied research and development can draw support. In particular, the overall objectives and current studies of the scene radiation and atmospheric effect characterization (SRAEC) project are reviewed. The SRAEC research can be generically structured into four types of activities including observation of phenomena, empirical characterization, analytical modeling, and scene radiation analysis and synthesis. The first three activities are the means by which the goal of scene radiation analysis and synthesis is achieved, and thus are considered priority activities during the early phases of the current project. Scene radiation analysis refers to the extraction of information describing the biogeophysical attributes of the scene from the spectral, spatial, and temporal radiance characteristics of the scene including the atmosphere. Scene radiation synthesis is the generation of realistic spectral, spatial, and temporal radiance values for a scene with a given set of biogeophysical attributes and atmospheric conditions. M.G.

**N84-21931*#** Colorado State Univ., Fort Collins. School of Forestry and Natural Resources.
**REFLECTANCE MODELING Abstract Only**
James A. Smith, K. Cooper, and M. Randolph *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 30 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

A classical description of the one dimensional radiative transfer treatment of vegetation canopies was completed and the results were tested against measured prairie (blue grama) and agricultural canopies (soybean). Phase functions are calculated in terms of directly measurable biophysical characteristics of the canopy medium. While the phase functions tend to exhibit backscattering anisotropy, their exact behavior is somewhat more complex and wavelength dependent. A Monte Carlo model was developed that treats soil surfaces with large periodic variations in three dimensions. A photon-ray tracing technology is used. Currently, the rough soil surface is described by analytic functions and appropriate geometric calculations performed. A bidirectional reflectance distribution function is calculated and, hence, available for other atmospheric or canopy reflectance models as a lower boundary condition. This technique is used together with an adding model to calculate several cases where Lambertian leaves possessing anisotropic leaf angle distributions yield non-Lambertian reflectance; similar behavior is exhibited for simulated soil surfaces. M.G.

**N84-21932*#** Nebraska Univ., Lincoln. Dept. of Agronomy.
**BIDIRECTIONAL REFLECTANCE MODELING OF NON-HOMOGENEOUS PLANT CANOPIES Abstract Only**
John M. Norman *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 31 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

Efforts to develop a three dimensional model to predict canopy, bidirectional reflectance for heterogenous plant stands using incident radiation and canopy structural descriptions as inputs are described. Utility programs were developed to cope with the complex output from the 3 dimensional model. In addition an attempt was made to define leaf and soil properties, which are appropriate to the mode, by measuring leaf and soil bidirectional reflectance distribution functions; since almost no data exist on these distributions. In the process it was realized that most models probably are using the wrong leaf spectral properties, and that off-nadir reflectance measurements are difficult to make because of non-Lambertian properties of reference surfaces. Also, in the visible wavebands, rough soil may not be distinguishable from canopies when viewed from above. M.G.

**N84-21933*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**COMPREHENSIVE UNDERSTANDING FOR VEGETATED SCENE RADIANCE RELATIONSHIPS Abstract Only**
Daniel S. Kimes and D. W. Deering *In its* Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 32 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

Directional reflectance distributions spanning the entire existent hemisphere were measured in two field studies; one using a Mark III 3-band radiometer and one using the rapid scanning bidirectional field instrument called PARABOLA. Surfaces measured included corn, soybeans, bare soils, grass lawn, orchard grass, alfalfa, cotton row crops, plowed field, annual grassland, stipa grass, hard wheat, salt plain shrubland, and irrigated wheat. Analysis of field data showed unique reflectance distributions ranging from bare soil to complete vegetation canopies. Physical mechanisms causing these trends were proposed. A 3-D model was developed and is unique in that it predicts: (1) the directional spectral reflectance factors as a function of the sensor's azimuth and zenith angles and the sensor's position above the canopy; (2) the spectral absorption as a function of location within the scene; and (3) the directional spectral radiance as a function of the sensor's location within the scene. Initial verification of the model as applied to a soybean row crop showed that the simulated directional data corresponded relatively well in gross trends to the measured data. The model was expanded to include the anisotropic scattering properties of leaves as a function of the leaf orientation distribution in both the zenith and azimuth angle modes. M.G.

**N84-21934*#** Purdue Univ., Lafayette, Ind.
**MEASUREMENT AND MODELING OF THE OPTICAL SCATTERING PROPERTIES OF CROP CANOPIES Abstract Only**
Vernan C. Vanderbilt and L. Grant *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 33 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

Efforts in measuring, analyzing, and mathematically modeling the specular, polarized, and diffuse light scattering properties of several plant canopies and their component parts (leaves, stems, fruit, soil) as a function of view angle and illumination angle are reported. Specific objectives were: (1) to demonstrate a technique for determining the specular and diffuse components of the reflectance factor of plant canopies; (2) to acquire the measurements and begin assembling a data set for developing and testing canopy reflectance models; (3) to design and build a new optical instrument to measure the light scattering properties of individual leaves; and (4) to use this instrument to survey and investigate the information in the light scattering properties of individual leaves of crops, forests, weeds, and horticulture. M.G.

**N84-21935*#** Hunter Coll., New York. Dept. of Geography.
**REFLECTANCE MODELING Abstract Only**
Alan H. Strahler *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 34 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

The main thrust of the work conducted is in the modeling of spectral responses of discontinuous conifer forest canopies, considered as collections of conical forms that are illuminated at an angle and cast shadows on contracting background. The three first-year objectives are: (1) modification of the variance-driven model to incorporate overlapping of shadows and crowns; (2) collection and analysis of photographic data to calibrate tree-spacing functions; and (3) collection of field data to determine height, spacing, and shape of conifers in open and closed stands in the Goosenest (California) test area. Modification of the invertible model uses a linear approximation to correct for the reduction in shadow and canopy area that occurs when shadows fall on crowns or tree crowns intersect. Comparison of the results of the approximation with a series of Monte Carlo simulations shows that the mean area covered by crowns or shadows is approximated quite accurately, but the variance calculated departs significantly from simulated values. The analysis of tree spacing patterns using air photos showed that spacing tended to be somewhat regular at a scale approximately equal to the average distance between trees, but at larger distance scales counts of trees in cells could be approximated acceptably by a Poisson (random) function. M.G.

**N84-21936*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**A STUDY OF THE RELATION BETWEEN CROP GROWTH AND SPECTRA REFLECTANCE PARAMETERS Abstract Only**
Gautam Badhwar *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 35 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

A differential equation describing the temporal behavior of greenness, G(t), with time was developed. The basic equation, dG(t)/dt=k(t)(1-G/G sub m) where G sub m is the saturation value of greenness at time, t sub p. It demonstrated that k(t) is linearly proportional to the rate of change of leaf area index. It was also demonstrated that G sub m, t sub p and profile width, are the key to vegetation identification and that the inflection points of the profile are related to the ontogenic state of the plant. These profile features were shown to hold not only throughout the United States corn/soybean growing area, but for the first time in Argentina. A mathematical technique that maximizes the sensitivity of spectral transformation to Leaf Area Index and simultaneously minimizes the sensitivity to all other variables was formulated. Initial results on corn and wheat were obtained. M.F.

**N84-21937*#** Kansas Univ., Lawrence. Center for Research.
**SCATTERING MODELS IN THE MICROWAVE REGIME**
Adrian K. Fung *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 37 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20N

Scattering from an inhomogeneous layer with irregular boundaries was calculated to model natural terrain such as a layer of vegetation or sea ice. The inhomogeneities were modeled by spherical or disc-shaped discrete scatterers which were small compared with the incident wavelength and were in the far field of one another. It was found that the cross-polarized scattering was dominated by multiple scattering effects and was sensitive to the orientations and distributions of the scatterers. This model has been applied to interpret measurements from vegetation, snow and sea ice. The scattering model was extended to handle disc-shaped scatterers which are comparable to the incident wavelength. The model was used to investigate the relative merits between active versus passive sensing of soil moisture over vegetated terrain. Results indicate that scattering mesurements are more sensitive to soil moisture changes than emission measurements. This is because while both types of measurements lose sensitivity to soil moisture because of the vegetation layer, the loss is greater for passive than active measurements. M.G.

**N84-21938*#** Massachusetts Inst. of Tech., Cambridge. Research Lab. for Electronics.
**REMOTE SENSING OF EARTH TERRAIN**
Jin-Au Kong *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 38 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 08B

Theoretical models that are useful and practical in relating remote sensing data to the important physical parameters characterizing Earth terrain are developed. The development of models that are useful in data analysis and interpretation, scene simulation, and developing new remote sensing approaches and techniques is discussed. Numerous theoretical models that are applicable to the active and passive remote sensing of plowed fields, atmospheric precipitation, vegetation, and snow fields were developed. The radiative transfer theory is used to interpret the active and passive data as a function of rain rate. Both the random medium model and the discrete scatterer model is used to study the remote sensing of vegetation fields. Due to the non-spherical geometry of the scatterers there is strong azimuthal dependence

in the observed data. Thus, the anisotropic random medium model and the discrete scatterer model with nonspherical particles was developed. In order to relate the remote sensing data to the actual physical parameters, the scattering of electromagnetic waves from randomly distributed dielectric scatterers was studied. Both the rigorous random discrete scatterer theory and the strong fluctuation theory are used to derive the backscattering cross section in terms of the actual physical parameters and the results agree well with the data obtained from the snow fields. M.A.C.

**N84-21939*#** George Washington Univ., Washington, D.C. Dept. of Electrical Engineering and Computer Science.
**DISCRETE RANDOM MEDIA TECHNIQUES FOR MICROWAVE MODELING OF VEGETATED TERRAIN Abstract Only**
Roger H. Lang *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 39 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20N

Microwave remote sensing of agricultural crops and forested regions is studied. Long term goals of the research involve modeling vegetation so that radar signatures can be used to infer the parameters which characterize the vegetation and underlying ground. Vegetation is modeled by discrete scatterers viz, leaves, stems, branches and trunks. These are replaced by glossy dielectric discs and cylinders. Rough surfaces are represented by their mean and spectral characteristics. Average scattered power is then calculated by employing discrete random media methodology such as the distorted Born approximation or transport theory. Both coherent and incoherent multiple scattering techniques are explored. Once direct methods are developed, inversion techniques can be investigated. M.A.C.

**N84-21940*#** Kansas Univ., Lawrence. Remote Sensing Lab.
**MEASURING AND MODELING OF THE DIELECTRIC PROPERTIES AND ATTENUATION OF VEGETATION Abstract Only**
Fawwaz T. Ulaby *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 40 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20N

The dielectric properties of vegetation material--primarily agricultural plants--as a function of moisture content and microwave frequency was measured and used to develop dielectric mixing models for the vegetation-water mixture. A model for the loss factor of a vegetation canopy was also developed. During the first phase of this investigation, three waveguide transmission systems covering from 1 to 2-GHz, from 3.5 to 6.5-GHz, and from 7.5 to 8.5-GHz bands were constructed and calibrated. By measuring the magnitude and phase of the field transmission coefficient of a given sample, it was possible to calculate the real and imaginary parts of the complex dielectric constant of the sample. Measurements were made for numerous samples of leaves and stalks of wheat and corn, and for wheat heads. Also, dielectric measurements were made of the liquid included in the vegetation material after extraction by mechanical means. The propagation loss is more than an order of magnitude greater than had previously been assumed. Various types of dielectric mixing models were investigated in terms of the available data, and a propagation model was developed and evaluated against direct canopy attenuation measurements. The canopy measurements were made by transmitting a signal from a radar antenna mounted atop a truck-mounted boom, and using a small antenna mounted on a rail beneath the canopy to receive it. M.A.C.

**N84-21941*#** Kansas Univ., Lawrence. Center for Research.
**DETERMINATION OF THE SOURCES OF RADAR SCATTERING Abstract Only** **c32**
R. K. Moore and R. Zoughi *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 41 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 17I

Fine-resolution radar backscattering measurements were proposed to determine the backscattering sources in various vegetation canopies and surface targets. The results were then used to improve the existing theoretical models of terrain scattering, and also to enhance understanding of the radar signal observed by an imaging radar over a vegetated area. Various experiments were performed on targets such as corn, milo, soybeans, grass, asphalt pavements, soil and concrete walkways. Due to the lack of available references on measurements of this type, the obtained results will be used primarily as a foundation or future experiments. The constituent backscattering characteristics of the vegetation canopies was also examined. M.A.C.

**N84-21942*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**EFFECTS OF VEGETATION CANOPY STRUCTURE ON MICROWAVE SCATTERING Abstract Only** **c32**
Jack F. Paris *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 42 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20N

The role of canopy structure on microwave backscattering is studied. Structure refers to the size, orientation, and vertical placement of scatterers in the canopy. Models to predict the backscattering coefficient, SIGMAO, of vegetation with explicit biophysical and explicit polarization-dependent parameters were developed. Preparation for field measurements with radar scatterometers was completed. Technical progress included: (1) the modification of the Attema and Ulaby (1977) model and its multilayer variation by Hoekman et al. (1983) to include polarization explicitly (i.e., to allow for separate backscattering cross sections, SIGMA, and extinction cross sections, Q, for each polarization), (2) the investigation of the modified model to isolate canopy element orientation parameters by the rationing of SIGMAO measurements for different polarization combinations, (3) the development of expressions for bistatic scattering and canopy-substrate scattering to supplement the models, (4) the performance of sensitivity analyses on these models, (5) the modification of the Attema and Ulaby model to alloy for changes, (6) the use of the modified model with a seasonal corn data set from Kansas (Eger et al., 1983), and (7) the initiation of preparations for empirical measurements with radar spectrometer and the Mobile Radar Scatterometer in irrigated cropland to test the models. M.A.C.

**N84-21943*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ATMOSPHERIC EFFECTS ON REMOTE SENSING OF THE EARTH'S SURFACE Abstract Only** **c46**
Robert E. Fraser and Y. Kaufman *In its* Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 44 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 04A

The main causes and magnitude of the atmospheric effects on remote sensing of the Earth's surface are determined. Theoretical study as well as measurements are included. The knowledge gained from this study will be used to develop atmospheric correction algorithms and to test them with satellite data. In a theoretical investigation of the relative effects of the aerosol optical thickness, absorption, and size distribution on remote sensing, it was found that aerosol absorption has a significant effect on satellite measurements of surface reflectivity. The absorption effect is stronger for high than for low surface reflectances. The aerosol optical thickness is dominant for small surface reflectances. The accuracy of clustering algorithms depends on both parameters. The vegetation index, however, is affected by the optical thickness but only weakly affected by the absorption. A laboratory simulation of the atmospheric effect on the radiance of sunlight scattered from the Earth's surface-atmosphere system was performed. This experiment verified the existence of the adjacency effect (the effect of a bright field on the radiance detected above a dark field) and was used to test 3-D radiative transfer models. In a theoretical study it was found that atmospheric scattering resulting from the adjacency effect reduces the separability between surface classes. M.A.C.

**N84-21944*#** EG & G Washington Analytical Services Center, Inc., Riverdale, Md.
**CHARACTERIZATION OF SURFACE REFLECTANCE VARIATION EFFECTS ON REMOTE SENSING Abstract Only** c46
William A. Pearce *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 45 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 04A

The use of Monte Carlo radiative transfer codes to simulate the effects on remote sensing in visible and infrared wavelengths of variables which affect classification is examined. These variables include detector viewing angle, atmospheric aerosol size distribution, aerosol vertical and horizontal distribution (e.g., finite clouds), the form of the bidirectional ground reflectance function, and horizontal variability of reflectance type and reflectivity (albedo). These simulations are used to characterize the sensitivity of observables (intensity and polarization) to variations in the underlying physical parameters both to improve algorithms for the removal of atmospheric effects and to identify techniques which can improve classification accuracy. It was necessary to revise and validate the simulation codes (CTRANS, ARTRAN, and the Mie scattering code) to improve efficiency and accommodate a new operational environment, and to build the basic software tools for acquisition and off-line manipulation of simulation results. Initial calculations compare cases in which increasing amounts of aerosol are shifted into the stratosphere, maintaining a constant optical depth. In the case of moderate aerosol optical depth, the effect on the spread function is to scale it linearly as would be expected from a single scattering model. Varying the viewing angle appears to provide the same qualitative effect as modifying the vertical optical depth (for Lambertian ground reflectance). M.A.C.

**N84-21945*#** Los Alamos Scientific Lab., N. Mex. Theoretical Div.
**MULTIDIMENSIONAL MODELING OF ATMOSPHERIC EFFECTS AND SURFACE HETEROGENEITIES ON REMOTE SENSING Abstract Only** c46
Siegfried A. Gerstl *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 46 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 04A

A modeling capability that allows a quantitative determination of atmospheric effects on remote sensing including the effects of surface heterogeneities is established. The objectives include: (1) the adaptation of existing radiative transfer codes to remote sensing applications, (2) the implementation of a realistic atmospheric data base, (3) the definition and verification against field measurements of a coupled atmosphere/canopy model, and (4) the quantitative characterization of the effects of some biophysical canopy parameters and soil surface boundary conditions on satellite-sensed Multispectral Scanner System (MSS) data. Substantial progress was also made in quantifying the effects of varying atmospheric turbidity and different non-Lambertian and specular ground reflectances on MSS data and its transforms like greenness and brightness. M.A.C.

**N84-21946*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**BIDIRECTIONAL SPECTRAL REFLECTANCE OF EARTH RESOURCES: INFLUENCE OF SCENE COMPLEXITY AND ATMOSPHERIC EFFECTS ON REMOTE SENSING Abstract Only** c46
David J. Diner *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 47 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 04A

Practical methods for remote sensing when scene complexity and atmospheric effects modify intrinsic reflective properties are developed. The radiation history from ground to space of light reflected from individual leaves is initially multiply scattered within the crop canopy, whose geometry provides a controlling influence, then scattered and attenuated as a result of transmission through the Earth's atmosphere. The experimental and theoretical tools for studying these effects quantitatively are under development. A new radiative transfer code which uses Fourier transforms to solve the 3-D equation of transfer was developed. The initial version permits inhomogeneous non-Lambertian surfaces but assumes horizontal uniformity for the atmosphere. The computational results are in excellent agreement with Monte Carlo calculations. Laboratory apparatus to study the variation of spectral reflectance of individual leaves as a function of illumination incidence angle and reflection angle was used. These data can then be used in models to determine canopy scattering effects. Stress tests by observing leaf reflectance at 0.9 microns as a function of time following clipping from the stem was performed. A reflectance increase due to loss of water has been observed. M.A.C.

**N84-21947*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**COMPREHENSIVE UNDERSTANDING FOR VEGETATED SCENE RADIANCE RELATIONSHIPS**
Daniel S. Kimes and D. W. Deering *In its* Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 75-86 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

The improvement of our fundamental understanding of the dynamics of directional scattering properties of vegetation canopies through analysis of field data and model simulation data is discussed. Directional reflectance distributions spanning the entire existance hemisphere were measured in two field studies; one using a Mark III 3-band radiometer and one using rapid scanning bidirectional field instrument called PARABOLA. Surfaces measured included corn, soybeans, bare soils, grass lawn, orchard grass, alfalfa, cotton row crops, plowed field, annual grassland, stipa grass, hard wheat, salt plain shrubland, and irrigated wheat. Some structural and optical measurements were taken. Field data show unique reflectance distributions ranging from bare soil to complete vegetation canopies. Physical mechanisms causing these trends are proposed based on scattering properties of soil and vegetation. Soil exhibited a strong backscattering peak toward the Sun. Complete vegetation exhibited a bowl distribution with the minimum reflectance near nadir. Incomplete vegetation canopies show shifting of the minimum reflectance off of nadir in the forward scattering direction because both the scattering properties or the vegetation and soil are observed. E.A.K.

**N84-21948*#** Purdue Univ., Lafayette, Ind.
**MEASUREMENT AND MODELING OF THE OPTICAL SCATTERING PROPERTIES OF CROP CANOPIES**
Vernan C. Vanderbilt and L. Grant *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 87-91 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

Progress and results in the measurement and scattering properties of crop canopies was examined. The following accomplishments are reported: (1) analysis of inhouse polarization, Sun/view angle data set of wheat was completed; (2) polarization photometer instrument system was completed; (3) light polarization properties (measured with polarization photometer) of individual plant leaves initiated, and twenty two species/varieties were measured before frost; (4) light polarizing properties of both moisture-stressed corn leaves and diseased wheat leaves were measured; (5) Sun/view angle data and ancillary data were acquired on two wheat canopies on two dates and on one sorghum canopy on two adjacent days. E.A.K.

**N84-21949*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**A STUDY OF THE RELATION BETWEEN CROP GROWTH AND SPECTRA REFLECTANCE PARAMETERS**
Gautam Badhwar *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 96-105 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20F

The relationship between crop growth and spectra reflectance

parameters was studied. The dynamic behavior of canopy reflectance versus time and the relationship of trajectories to canopy dynamics, ontogeny and morphology was investigated. The determination of which transformations of spectral data best suited for observing key canopy characteristics, such as leaf area index and vegetation identification are understood. A physical basis to understand how various spectral transform trajectories depend on vegetation type and models that describe the time delayed interaction of reflectance in the chlorophyll and water absorption bands to monitor stress were formulated. The general process of physical understanding of canopy reflectance is evaluated and existing canopy models are improved. E.A.K.

**N84-21950*#** Kansas Univ., Lawrence. Center for Research.
**SCATTERING MODELS IN THE MICROWAVE REGIME**
Adrian K. Fung *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 106-121 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20N

Vegetation growth observations by microwave scattering was investigated. The purpose of the study was: (1) to develop scattering models for an inhomogeneous medium; (2) to develop scattering models for an irregular surface; (3) to combine volume and surface scattering to obtain useful scattering and emission models for terrains; and (4) to apply the developed model to the interpretation of measured data and the design of future experiments. E.A.K.

**N84-21951*#** Massachusetts Inst. of Tech., Cambridge. Research Lab. for Electronics.
**REMOTE SENSING OF EARTH TERRAIN**
Jin-Au Kong *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 122-147 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 08B

Work performed on remote sensing of each terrain is outlined. The purpose of the investigation was: (1) development of theoretical models for remote sensing of Earth terrain; (2) data analysis and interpretation using the models developed; (3) scene simulation; and (4) development of new remote sensing approaches and techniques. E.A.K.

**N84-21952*#** George Washington Univ., Washington, D.C. Dept. of Electrical Engineering and Computer Science.
**DISCRETE RANDOM MEDIA TECHNIQUES FOR MICROWAVE MODELING OF VEGETATED TERRAIN**
Roger H. Lang *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 148-157 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20N

Microwave modeling of vegetated terrain was investigated. The purpose was to: (1) use discrete scatter theory to model vegetation (crops and forested regions) in microwave region; (2) develop models for scatterers and ground; (3) multiple scattering analysis relate model parameters to average scattered power; and (4) develop inversion techniques to remotely determine model parameters. E.A.K.

**N84-21953*#** Kansas Univ., Lawrence. Remote Sensing Lab.
**MEASURING AND MODELING OF THE DIELECTRIC PROPERTIES AND ATTENUATION OF VEGETATION**
Fawwaz T. Ulaby *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 158-160 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 20N

The dielectric properties and attenuation of vegetation was measured and modeled. The purpose was to: (1) measure the microwave dielectric properties of vegetation material as a function of moisture content and microwave frequency; (2) develop dielectric mixing models for the vegetation-water mixture; (3) develop a model for the loss factor of a vegetation canopy; (4) relate the results of (1) and (2) to (3); and (5) test the model in (3) against direct canopy transmission measurements. E.A.K.

**N84-21954*#** Kansas Univ., Lawrence. Center for Research.
**DETERMINATION OF THE SOURCES OF RADAR SCATTERING**
R. K. Moore, R. Zonghi, L. K. Wu, A. Afifi, and Fawwaz T. Ulaby *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 161-175 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 17I

The sources of radar backscattering sources in vegetation canopies and surface targets were determined. The fundamental questions were, how much of backscattering is due to direct volume backscatter by the canopy, the soil, and indirect backscatter by soil/vegetation, and what are the relative roles in terms of scattering. The results for crops, milo plant, wheat plant, soybean plant, and surface targets are reported. E.A.K.

**N84-21955*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**SATELLITE-DERIVED SEA SURFACE TEMPERATURE: WORKSHOP 1**
Eni G. Njoku 1 May 1983 156 p refs Workshop held in Pasadena, Calif., 27-28 Jan. 1983
(Contract NAS7-918)
(NASA-CR-173450; JPL-Pub-83-34; NAS 1.26:173450) Avail: NTIS HC A08/MF A01 CSCL 05B

Satellite measurements of sea surface temperature are now possible using a variety of sensors. The present accuracies of these methods are in the range of 0.5 to 2.0 C. This makes them potentially useful for synoptic studies of ocean currents and for global monitoring of climatological anomalies. To improve confidence in the satellite data, objective evaluations of sensor accuracies are necessary, and the conditions under which these accuracies degrade need to be understood. The Scanning Multichannel Microwave Radiometer (SMMR) on the Nimbus-7 satellite was studied. Sea surface temperatures, derived from November 1979 SMMR data, were compared globally against ship measurements and climatology, using facilities of the JPL Pilot Ocean Data System. Methods for improved data analysis and plans for additional workshops to incorporate data from other sensors were discussed. For individual titles, see N84-21956 through N84-21969.

**N84-21956*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**SATELLITE-DERIVED SEA SURFACE TEMPERATURE: INTRODUCTION**
Eni G. Njoku *In its* Satellite-Derived Sea Surface Temp. 1 May 1983 8 p (For primary document see N84-21955 12-43)
Avail: NTIS HC A08/MF A01 CSCL 05B

Satellites now play an increasing role in systematic monitoring of the global oceans. Measurements of sea surface temperature (SST) are of primary importance in understanding heat storage and transport within the ocean and cross the ocean-atmosphere boundary. In some regions, local changes in SST of only 1 to 2 C have major effects on global climate and weather patterns. The satellite measurements provide a data base complementary to the (sometimes) accurate but sparsely-distributed point measurements available from ships and buoys. The demands placed on satellite sensors are stringent. Accuracies of better than 1 C are required and are often desired to a few tenths of a degree. Furthermore, measurement accuracies must be stable spatially and temporally in order for satellite data to be used with confidence in models of air-sea interaction and climate. There now exists a need to evaluate objectively the performance of the latest generation of sensors under a sufficient variety of environmental conditions to indicate present accuracies, deficiencies, and potential for improvement. Author

**N84-21957*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ANALYSIS TECHNIQUES**
Dudley Chelton *In its* Satellite-Derived Sea Surface Temp. 1 May 1983 6 p (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 05B

Analysis techniques for the sea surface temperature (SST) intercomparison were discussed. Systematic differences between various measurement techniques were identified and examined. This in turn might reveal areas for needed improvement in the SST retrieval algorithms or, at the very least, a clearer understanding of the limitations of each sensor. B.G.

**N84-21958*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**PROCESSING SYSTEM**

Jeffrey E. Hilland *In its* Satellite-Derived Sea Surface Temp. 1 May 1983 8 p (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 05B

To implement the analysis techniques and to provide end-to-end processing, a system was designed with the following capabilities: receive and catalog data from many sources; organize the data on mass storage for rapid access; edit for reasonableness; create new data sets by sorting on parameter, averaging and merging; provide statistical analysis and display tools; and distribute data on demand. Consideration was given to developing a flexible system that could meet immediate workshop needs and respond to future requirements. System architecture and data set details implemented are discussed. Author

**N84-21959*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**IN SITU DATA**

Steven Pazan *In its* Satellite-Derived Sea Surface Temp. 1 May 1983 16 p (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 05B

The evidence indicates that November 1979 was a very climatological month, certainly in the Atlantic. This must make us particularly wary of deviations from climatology anywhere in the globe during this period. The McLain and Pazan SST analyses are identical to within a degree. The Pazan ship data need to be edited against climatology in order to remove bad ship data. Author

**N84-21960*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**SATELLITE DATA**

Eni G. Njoku *In its* Satellite-Derived Sea Surface Temp. 1 May 1983 9 p (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 05B

Three satellite SST data sets were analyzed, all derived from the Scanning Multichannel Microwave Radiometer (SMMR) on the Nimbus-7 satellite. The SMMR is a ten-channel instrument flown also on the SEASAT satellite (now defunct) and was designed to measure SST in addition to other oceanographic and meteorological parameters. The three SMMR data sets were referred to as SMMR-I, -II, and -III. SMMR-I and -II were produced by T. Wilheit and A. Milman, SMMR-II being an updated and refined version of SMMR-I. A description of the algorithms used is provided. SMMR-III was provided by C. Prabhakara and was obtained by a different retrieval approach from the others. For consistency with the file code conventions and to avoid confusion, SMMRs I, II, and III were renamed SMMR-A, SMMR-D, and SMMR-C, respectively. Author

**N84-21961*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**COMPARISON OF SATELLITE AND IN SITU DATA**

Robert L. Bernstein *In its* Satellite-Derived Sea Surface Temp. 1 May 1983 11 p (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 05B

A variety of data sets were available and analyzed. The data sets discussed here are: (1) SMMR-A: The Nimbus Project data release; (2) SMMR-D: The revised SMMR version produced by Wilheit and Milman; (3) SMMR-C: The SMMR version produced by Prabhakara; (4) Fleet Numerical Oceanography Center (PNOC): The individual ship reports; and (5) Reynolds Climatology. Data from SMMR and PNOC ships were compared in three different ways: (1) The difference between individual ship and SMMR observations which were close in space and time. (2) The difference between the 20 degree lat-lon one month averages for SMMR and ship, respectively. (3) The difference between the 20 degree averages and climatology, for both SMMR and ship. Author

**N84-21962*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**CONCLUSIONS AND RECOMMENDATIONS**

*In its* Satellite-Derived Sea Surface Temp. 1 May 1983 8 p (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 05B

From the analyses performed thus far, it is clear that the ship data must be treated with great care in any satellite comparisons because of their high noise level. At the very least, the ship data should be screened to eliminate observations deviating unreasonably from climatology. In fact, a two pass screening is better, with the second pass screening out data deviating unreasonably from the first pass mapping attempt. Even with screening, the noise level is comparable with that of the satellite data and, particularly in spot comparisons, should not be used to evaluate the accuracy of the satellite data. Consideration also should be given to more sophisticated mapping procedures than simple binning averaging. Procedures that attempt local least squares fitting to individual observations would give better results because they would then be less sensitive to the spatial distribution of the data. Author

**N84-21963*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**SEA SURFACE TEMPERATURES FROM THE NIMBUS-7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER**

Andrew S. Milman (Systems and Applied Science Corp., Hyattsville, Md.) and Thomas T. Wilheit *In* JPL Satellite-Derived Sea Surface Temp. 1 May 1983 20 p refs (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 08J

The algorithm was developed to determine sea surface temperature (SST) from the Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) data. The SST algorithm has evolved over the last several years. The final version that will be applied to the 1979 SMMR data (more tuning may be needed for later data) is described. Four different stages in the development are reported: Versions I to IV; each version has evolved out of its predecessor either because newly processed data became available or because significant problems were uncovered in earlier versions. Author

**N84-21964*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**A STATISTICAL METHOD TO SENSE SEA SURFACE TEMPERATURE FROM THE NIMBUS-7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER**

Cuddappah Prabhakara and I. Wang *In* JPL Satellite-Derived Sea Surface Temp. 1 May 1983 8 p (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 08J

Among the five channels in the Scanning Multichannel Microwave Radiometer (SMMR), the brightness temperature measured at 6.6 GHz vertical polarization is least affected by the atmospheric water vapor and liquid water in clouds or rain. Furthermore, as the undisturbed sea surface emissivity at 6.6 GHz is nearly constant over the temperature range 275 to 300 K, this channel has the best sensitivity to sea surface temperature (SST). The 6.6 GHz channel on SMMR is specifically chosen for these reasons to measure SST. Author

**N84-21965*#** National Oceanic and Atmospheric Administration, Suitland, Md.

**NOAA SATELLITE-DERIVED OPERATIONAL SEA SURFACE TEMPERATURE PRODUCTS**

E. Paul McClain *In* JPL Satellite-Derived Sea Surface Temp. 1 May 1983 17 p refs (For primary document see N84-21955 12-43)

Avail: NTIS HC A08/MF A01 CSCL 08J

The National Oceanic and Atmospheric Administration (NOAA) began processing global measurements of emitted radiation in the 10.5 to 12.5 micron atmospheric window for purposes of deriving weekly composite and mean monthly sea surface temperature fields in the early 1970s. Atmospheric attenuation corrections, begun with empirical means, were accomplished chiefly with the aid of coarser resolution measurements from atmospheric sounders aboard the same polar orbiting spacecraft. Cloud filtering depended heavily upon the use of histogram techniques applied to 11 x 11 arrays of 8 km resolution Scanning Radiometer Infrared (SRIR) data. Details of the SRIR processing for SST are found in a NOAA Technical Memorandum. Author

**N84-21966*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**MEASUREMENT OF SEA SURFACE TEMPERATURE FROM HIRS2/MSU**

Joel Susskind *In* JPL Satellite-Derived Sea Surface Temp. 1 May 1983 11 p refs (For primary document see N84-21955 12-43)
Avail: NTIS HC A08/MF A01 CSCL 08J

The High-Resolution Infrared Sounder (HIRS), a 20-channel infrared sounder, and the Microwave Sounding Unit (MSU), a 4-channel microwave sounder, were first launched on the TIROS-N Satellite in November 1978 as an upgraded operational temperature sounding system. Essentially identical instruments have flown on NOAA-6 and NOAA-7 and are scheduled to fly on future operational satellites through the eighties. While HIRS2 and MSU were designed primarily for the purpose of measuring atmospheric temperature profiles, the observed radiances are also sensitive to other meteorological parameters such as sea surface temperature, ground temperature, cloud height and cloud amount, ice extent over ocean, snow cover over land, etc. A physically based processing system for analysis of HIRS2/MSU data was developed to determine the above atmospheric and surface parameters, which when substituted in the radiative transfer equation, match the satellite observations to a given noise level. All parameters are retrieved in a mutually interacting fashion. Author

**N84-21967*#** Wisconsin Univ., Madison.

**USE OF VAS MULTISPECTRAL DATA FOR SEA SURFACE TEMPERATURE DETERMINATION**

John Bates *In* JPL Satellite-Derived Sea Surface Temp. 1 May 1983 7 p refs (For primary document see N84-21955 12-43)
Avail: NTIS HC A08/MF A01 CSCL 08J

The Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VAS) is a radiometer possessing eight visible channel detectors and six thermal detectors that sense infrared radiation in 12 spectral bands. Housed in the GOES satellite, VAS spins in a west to east direction at 100 rpm and achieves spatial coverage at resolutions of 1 km in the visible and 7 or 14 km in the infrared by stepping a scan mirror in a north to south direction. Designed for multipurpose applications, the VAS can be operated in two different modes: (1) a multi-spectral imaging (MSI) mode, and (2) a dwell sounding (DS) mode. The MSI mode of operation is used for sea surface temperature (SST) determination. Currently, a full-disk MSI image for SST determination is received every hour, 18 hours a day during weekdays. This MSI mode of operation for SST consists of data obtained from wavelengths centered at 3.9 microns (channel 12), 11.6 microns (channel 8), and 12.6 microns (channel 7) as well as visible data. Author

**N84-21968*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**PILOT OCEAN DATA SYSTEM (PODS) FILE FORMAT SPECIFICATIONS**

*In its* Satellite-Derived Sea Surface Temp. 1 May 1983 9 p (For primary document see N84-21955 12-43)
Avail: NTIS HC A08/MF A01 CSCL 08J

Sea surface temperature data are contained in the following categories: tapefile format, raw file format, bin format, GRD format, MFM file format, SZM format, MRG file format, and DIF file format. B.G.

**N84-21969*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**THREE-WAY PARTITIONING OF SEA SURFACE TEMPERATURE MEASUREMENT ERROR**

Dudley Chelton *In its* Satellite-Derived Sea Surface Temp. 1 May 1983 2 p (For primary document see N84-21955 12-43)
Avail: NTIS HC A08/MF A01 CSCL 08J

Given any set of three 2 degree binned anomaly sea surface temperature (SST) data sets by three different sensors, estimates of the mean square error of each sensor estimate is made. The above formalism performed on every possible triplet of sensors. A separate table of error estimates is then constructed for each sensor. Author

**N84-21970#** Stanford Univ., Calif. Artificial Intelligence Lab.

**STEREO RECONSTRUCTION STUDY Final Technical Report, Sep. 1981 - Apr. 1982**

T. O. Binford Griffiss AFB, N.Y. RADC Jun. 1983 263 p
(Contract F30602-78-C-0083; ARPA Order 4302; AF Proj. D302)
(AD-A138208; RADC-TR-82-270) Avail: NTIS HC A12/MF A01 CSCL 08/2

This report surveys stereo mapping systems and related and supporting techniques. Included are these topics: Current stereo mapping systems, model based image analysis systems, image segmentation, image registration, correspondence constraints for stereopsis, hardware and architecture for computer vision, psychology and neurophysiology of vision. Author (GRA)

**N84-21971#** Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.

**MEASUREMENT OF OCEAN SURFACE WINDS BY SEASAT SYNTHETIC APERTURE RADAR**

J. D. Lyden, D. R. Lyzenga, R. A. Shuchman, and W. L. Jones Jul. 1983 105 p
(Contract N00014-81-C-0692)
(AD-A138392; ERIM-155900-15-T) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report investigates the feasibility of using SEASAT Synthetic Aperture Radar (SAR) data for measuring ocean surface winds. An empirical model relating the received power of the L-band SAR to ocean surface wind conditions was evaluated. Results from this investigation indicate that past SEASAT SAR wind studies could be biased due to the nature of the measurement techniques employed. In these past studies, densitometer measurements of output imagery were related to wind speed and direction. Because of a shifting of the Doppler spectrum location with latitude due to the Earth's rotation and spacecraft attitude change, these measurements are valid only over short azimuthal distances. A theoretical correction was calculated and applied to the SEASAT data, resulting in improved correlations with the surface wind speed. Additionally, a simplified measurement technique which did not involve explicit corrections for this Doppler shifting was developed. The results of this study are consistent with those of previous investigations, but yield additional insight into the angular dependence of the SAR backscatter and the accuracy of the technique. GRA

**N84-21972#** Texas Univ., Austin. Center for Energy Studies.

**ANALYSIS OF SWEET LAKE GEOPRESSURED-GEOTHERMAL AQUIFER**

M. Andrade, F. M. Rago, H. Ohkuma, K. Sepehrnoori, E. Peters, and M. Dorfman Jan. 1983 30 p refs
(Contract DE-AC08-79ET-27112)
(DE84-006053; DOE/ET-27112/4) Avail: NTIS HC A03/MF A01

The Sweet Lake geopressured geothermal aquifer, located southeast of Lake Charles, Louisiana, is an aquifer modeled by a two dimensional geopressured geothermal simulator. This aquifer is a sandstone within the Frio formation at depths between 15,000 to 15,640 ft with a net porous thickness of 250 ft, a calculated in situ permeability of 17 md, an estimated porosity of

240, a uniaxial compaction coefficient of 4.5 x 10(-7) psi(-1) and a solution gas water ratio of 11 SCF/STB all at the initial reservoir pressure of 12,060 psi. These parameters are typically pressure sensitive in geopressure geothermal aquifers and are critically important to aquifer performance. The effects of varying initial values for these parameters with the experimentally determined values as means were investigated. The expected life of the geopressure geothermal well is reported for each simulation. DOE

**N84-21973#** Stone and Webster Engineering Corp., Boston, Mass.
**MAJOR SALT BEDS OF THE PALO DURO AND DALHART BASINS, TEXAS**
Dec. 1983 71 p refs
(Contracts DE-AC02-83CH-10140; DE-AC06-76RL-01830)
(DE84-005255; BMI/ONWI-518) Avail: NTIS HC A04/MF A01

Major salt beds which are defined as salt intervals at least 75 feet thick that contain no interbeds greater than 10 feet thick and include no more than 15% nonsalt interbeds are outlined. Maps based on the interpretation of geophysical logs from hundreds of oil and gas exploration wells reveal seven major salt beds in the Palo Duro Basin and one major salt bed in the Dalhart Basin. The most extensive major salt beds are in the central and northern Palo Duro Basin, in the Upper San Andres Formation and the Lower San Andres Formation Units 4 and 5. The major salt bed within the Lower San Andres Formation Unit 4 is the most widespread and generally the thickest. DOE

**N84-21974#** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
**FEASIBILITY STUDY OF ADVANCED OPTICAL TECHNIQUES FOR OCEAN COLOR MEASUREMENT Final Report**
R. Czichy, J. Doenecke, H. Heinze, M. Hofmann, H. Hufnagel, G. Klein, B. Kunkel, H. Laucht, W. Schattmann, M. Cutter (SIRA Inst. Ltd.) et al Paris ESA Jul. 1983 297 p refs Prepared in cooperation with SIRA Inst. Ltd. and University College, Dublin
(Contract ESA-5235/82/F-CG(SC))
(MBB-R3700/292; ESA-CR(P)-1822) Avail: NTIS HC A13/MF A01

An electronic scanning ocean color measurement instrument concept was developed. Radiometric characteristics of 10 spectral channels, and optical, channel separation, and focal plane assembly concepts were studied. The preferred concept is fully modular with refractive lens systems per channel. Radiometry, image quality, mechanical and thermal adjustment precision, and calibration were investigated. Conceptual design of the optics; control and data processing electronics, and spacecraft interface specification are outlined. Author (ESA)

**N84-21975#** Kiel Univ. (West Germany). Abt. Theoretische Ozeanographie.
**DETERMINATION OF SEA SURFACE TEMPERATURES FROM HIGH RESOLUTION INFRARED SATELLITE MEASUREMENTS Thesis [BESTIMMUNG DER MEERESOBERFLAECHENTEMPERATUR MITTELS HOCHAUFLOESENDER INFAROT-SATELLITENMESSUNGEN]**
Thomas Viehoff 1983 134 p refs In GERMAN; ENGLISH summary
(Rept-115; ISSN-0341-8561) Avail: NTIS HC A07/MF A01

Determination of sea surface temperatures by the polar orbit satellite NOAA 7 is reported. Advanced very high resolution radiometry (AVHRR) was employed. Geographic location of data points and distinction between ocean surface and cloud signals were emphasized. Split-window technique was used to correct atmospheric attenuation. Insufficient knowledge of orbit and tilt parameters made necessary a manual correction of the computed geographic locations to obtain an accuracy of 2.5 km. A comparison between radiometrically measured temperatures and ground truth measurements was made during two orbits. The mean difference is within the margins of error. The thermal patterns at the sea surface correspond. Significant temperature differences only exist due to temporal difference between the two measurements. Author (ESA)

**N84-21976#** Bristol Univ. (England). nj943970
**AgRISTARS STAGE 3: THE BRISTOL INTERACTIVE SCHEME (BIAS) FOR SATELLITE-IMPROVED RAINFALL MONITORING: FURTHER DEVELOPMENTS, TESTING AND METHOD DESCRIPTION Final Report**
Eric C. Barrett 31 Aug. 1983 104 p refs
(Contract NA82SA-C-00083)
(PB84-150630; NOAA-84012601) Avail: NTIS HC A06/MF A01 CSCL 04B

Since about 1970 interest in the possibility of using weather satellite data as an aid in rainfall monitoring has steadily grown. The initiation of the AgRISTARS (Agriculture & Resource Inventory Surveys through Aerospace Remote Sensing) Program in 1979 afforded a new focus for such work, linked particularly to the aims of developing an early warning system for conditions affecting crop production. The 'Bristol Method' is a cloud-indexing technique of satellite-improved rainfall monitoring designed originally to combine conventional and polar-orbiting satellite data into single assessments of 12-hourly rainfall totals. As such it has been identified by NOAA as a potentially useful complement to geostationary (life-history) techniques for the rainfall segments of AgRISTARS. GRA

**N84-21575#** Joint Publications Research Service, Arlington, Va.
**TECHNIQUES AND INSTRUMENTS FOR COSMONAUT REMOTE SENSING**
L. Kiselevskiy and V. Kovalenok *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 28-30 Transl. into ENGLISH from Pravda (Moscow), 5 Aug. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

**N84-22068*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A LAGRANGIAN METHOD FOR A TWO LAYER SHALLOW WATER MODEL**
J. M. Augenbaum *In its* Res. Rev., 1983 Jan. 1984 p 90-94 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 08H

**N84-22103*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A NOTE ON THE TEMPORAL BEHAVIOR OF BUCKET HYDROLOGIES**
M. J. Suarez *In its* Res. Rev., 1983 Jan. 1984 p 275-284 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 08H

**N84-22104*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**TIME DEPENDENT LAND AND VEGETATION CANOPY TEMPERATURES**
Y. C. Sud *In its* Res. Rev., 1983 Jan. 1984 p 285-291 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 02F

# 44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

**N84-21977*#** National Aeronautics and Space Administration, Washington, D. C.
**ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES,**

**ISSUE 40, JANUARY 1984**
Jan. 1984 212 p
(NASA-SP-7043(40)); NAS 1.21:7043(40)) Avail: NTIS HC $15.00 CSCL 10A

This bibliography lists 775 reports, articles and other documents introduced into the NASA scientific and technical information system from October 1, 1983 through December 31, 1983. A.R.H.

**N84-21978#** Argonne National Lab., Ill. Electronics Div.
**AIR- VERSUS LIQUID-BASED SOLAR-ENERGY SYSTEMS: A COMPARISON OF MEASURED THERMAL PERFORMANCES**
Donald R. Patterson Mar. 1983 27 p refs
(Contract W-31-109-eng-38)
(ANL-83-45) Avail: NTIS HC A03/MF A01

A comparison of the thermal performance of five liquid based solar energy systems to five air based solar energy systems is presented. Data for each of these ten sites was collected and converted to uniformly defined performance factors. The ten sites are all single family residences using solar energy to supply part of the space and water heating loads. Each performance factor was discussed, and when the data showed a significant difference, the reasons for and the significance of these differences were discussed. Author

**N84-21979#** Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
**PHOTOVOLTAIC ENERGY SYSTEMS Program Summary, fiscal year 1982**
Apr. 1983 429 p Prepared in cooperation with JPL
(Contracts DE-AC02-77-CH-00178; DE-AC01-76ET-20356)
(DOE/CE-0033/1) Avail: NTIS HC A19/MF A01

The goal of the Federal Photovoltaics Program is to advance the scientific understanding of photovoltaics and to establish the technology base from which private enterprise may choose photovoltaic power production options for further industrial development and for introduction into the competitive energy market. The program summary is divided into three sections: a brief introduction which includes a list of directing organizations, a list of abbreviations and acronyms, and an index of contractors; the contract summaries; and the FY1981 to 1982 publications. Author

**N84-21980*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PROCEEDINGS OF THE FLAT-PLATE SOLAR ARRAY PROJECT RESEARCH FORUM ON PHOTOVOLTAIC METALLIZATION SYSTEMS**
15 Nov. 1983 419 p refs Forum held at Pine Mountain, Ga., 16-18 Mar. 1983
(Contract DE-AI01-76ET-20356)
(NASA-CR-173477; JPL-Pub-83-93; JPL-5101-239; DOE/JPL-1012/92; NAS 1.26:173477) Avail: NTIS HC A18/MF A01 CSCL 10A

A photovoltaic Metallization Research forum, under the sponsorship of the Flat-Plate Solar Array Project consisted of five sessions, covering: (1) the current status of metallization systems, (2) system design, (3) thick-film metallization, (4) advanced techniques, and (5) future metallization challenges. For individual titles, see N84-21981 through N84-22000.

**N84-21981*#** Photowatt International, Inc., Tempe, Ariz.
**SOLAR CELL METALLIZATION: HISTORICAL PERSPECTIVE**
William E. Taylor *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 9-18 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Solar cell metallization design requirements are discussed. Space applications and terrestrial applications are considered. Cost factors are discussed in relation to design analysis. B.W.

**N84-21982*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ECONOMIC IMPLICATIONS OF CURRENT SYSTEMS**
Ronald E. Daniel and R. W. Aster *In its* Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 19-33 refs (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

The primary goals of this study are to estimate the value of R&D to photovoltaic (PV) metallization systems cost, and to provide a method for selecting an optimal metallization method for any given PV system. The value-added cost and relative electrical performance of 25 state-of-the-art (SOA) and advanced metallization system techniques are compared. Author

**N84-21983*#** Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
**ACCELERATED DEGRADATION OF SILICON METALLIZATION SYSTEMS**
Jay W. Lathrop *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 35-57 refs (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Clemson University has been engaged for the past five years in a program to determine the reliability attributes of solar cells by means of accelerated test procedures. The cells are electrically measured and visually inspected and then subjected for a period of time to stress in excess of that normally encountered in use, and then they are reinspected. Changes are noted and the process repeated. This testing has thus far involved 23 different unencapsulated cell types from 12 different manufacturers, and 10 different encapsulated cell types from 9 different manufacturers. Reliability attributes of metallization systems can be classified as major or minor, depending on the severity of the effects observed. As a result of the accelerated testing conducted under the Clemson program, major effects have been observed related to contact resistance and to mechanical adherence and solderability. This paper does not attempt a generalized survey of accelerated test results, but rather concentrates on one particular attribute of metallization that has been observed to cause electrical degradation - increased contact resistance due to Schottky barrier formation. In this example basic semiconductor theory was able to provide an understanding of the electrical effects observed during accelerated stress testing. B.W.

**N84-21984*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**FIELD TEST EXPERIENCE**
Robert W. Weaver *In its* Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 59-68 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

As a part of the Flat-Plate Solar Array Project (FSA), a field-test program was developed to obtain solar photovoltaic (PV) module performance and endurance data. These data are used to identify the specific characteristics of module designs under various environmental conditions. The information obtained from field testing is useful to all participants in the National Photovoltaics Program, from the research planner to the life-cycle cost analyst. Author

**N84-21985*#** Arizona State Univ., Tempe.
**FUNDAMENTALS OF METAL-SEMICONDUCTOR CONTACTS** **c76**
Dieter K. Schroder *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 69-93 refs (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 20L

The fundamentals of metal-semiconductor contacts are discussed. Contact resistance values for solar cells are also discussed. B.W.

**N84-21986*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**GETTING THE CURRENT OUT Abstract Only**
Dale R. Burger *In its* Proc. of the Flat-Plate Solar Array Res.

Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 95 refs (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Progress of a photovoltaic (PV) device from a research concept to a competitive power-generation source requires an increasing concern with current collection. The initial metallization focus is usually on contact resistance, since a good ohmic contact is desirable for accurate device characterization measurements. As the device grows in size, sheet resistance losses become important and a metal grid is usually added to reduce the effective sheet resistance. Later, as size and conversion efficiency continue to increase, grid-line resistance and cell shadowing must be considered simultaneously, because grid-line resistance is inversely related to total grid-line area and cell shadowing is directly related. A PV cell grid design must consider the five power-loss phenomena mentioned above: sheet resistance, contact resistance, grid resistance, bus-bar resistance and cell shadowing. Although cost, reliability and usage are important factors in deciding upon the best metallization system, this paper will focus only upon grid-line design and substrate material problems for flat-plate solar arrays. B.W.

**N84-21987*#** California Inst. of Tech., Pasadena.
**DIFFUSION BARRIERS**
Marc-A. Nicolet *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 113-136 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

The choice of the metallic film for the contact to a semiconductor device is discussed. One way to try to stabilize a contact is by interposing a thin film of a material that has low diffusivity for the atoms in question. This thin film application is known as a diffusion barrier. Three types of barriers can be distinguished. The stuffed barrier derives its low atomic diffusivity to impurities that concentrate along the extended defects of a polycrystalline layer. Sacrificial barriers exploit the fact that some (elemental) thin films react in a laterally uniform and reproducible fashion. Sacrificial barriers have the advantage that the point of their failure is predictable. Passive barriers are those most closely approximating an ideal barrier. The most-studied case is that of sputtered TiN films. Stuffed barriers may be viewed as passive barriers whose low diffusivity material extends along the defects of the polycrystalline host. B.W.

**N84-21988*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**OBSERVATIONS OF SOLAR-CELL METALLIZATION CORROSION**
Gordon R. Mon *In its* Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 137-146 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

The Engineering Sciences Area of the Jet Propulsion Laboratory (JPL) Flat-Plate Solar Array Project is performing long term environmental tests on photovoltaic modules at Wyle Laboratories in Huntsville, Alabama. Some modules have been exposed to 85 C/85% RH and 40 C/93% RH for up to 280 days. Other modules undergoing temperature-only exposures (< 3% RH) at 85 C and 100 C have been tested for more than 180 days. At least two modules of each design type are exposed to each environment - one with, and the other without a 100-mA forward bias. Degradation is both visually observed and electrically monitored. Visual observations of changes in appearance are recorded at each inspection time. Significant visual observations relating to metallization corrosion (and/or metallization-induced corrosion) include discoloration (yellowing and browning) of grid lines, migration of grid line material into the encapsulation (blossoming), the appearance of rainbow-like diffraction patterns on the grid lines, and brown spots on collectors and grid lines. All of these observations were recorded for electrically biased modules in the 280-day tests with humidity. Author

**N84-21989*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**MODULE DEGRADATION CATALYZED BY METAL-ENCAPSULATION REACTIONS Abstract Only**
Brian D. Gallagher *In its* Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 147-157 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Four major properties are considered to be relevant in determining service life of a photovoltaic module: (1) Mechanical: creep resistance, modulus, tensile strength; (2) Optical: integrated transmission at 0.4 to 1.1 m wavelength; (3) Chemical: inertness with respect to metals and other components, retention of stabilizers, etc. and (4) Electrical; maintaining effective isolation of conductive components. These properties were measured after exposing polymer specimens to three types of accelerated stress: thermal, ultraviolet radiation and metal catalysts. These conditions give rise to a large number of complex interrelated free-radical reactions that result in the deterioration of polymeric materials. B.W.

**N84-21990*#** Applied Solar Energy Corp., City of Industry, Calif.
**METALLIZATION PROBLEMS WITH CONCENTRATOR CELLS**
Peter A. Iles *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 159-169 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Cells used with concentrators have similar contact requirements to other cells, but operation at high intensity imposes more than the usual demands on the metallization. Overall contact requirements are listed and concentrator cell requirements are discussed. B.W.

**N84-21991*#** Purdue Univ., Lafayette, Ind.
**EFFECTS OF PARTICLE SIZE DISTRIBUTION IN THICK FILM CONDUCTORS** c76
Robert W. Vest *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 173-194 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 20L

Studies of particle size distribution in thick film conductors are discussed. The distribution of particle sizes does have an effect on fired film density but the effect is not always positive. A proper distribution of sizes is necessary, and while the theoretical models can serve as guides to selecting this proper distribution, improved densities can be achieved by empirical variations from the predictions of the models. R.J.F.

**N84-21992*#** Ferro Corp., Santa Barbara, Calif. Thick Film Systems.
**PARTICLE SIZE EFFECTS ON VISCOSITY OF SILVER PASTES: A MANUFACTURER'S VIEW**
Jason Provance and Kevin Allison *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 195-214 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Particles from a variety of silver powders were investigated by scanning electron microscopy and particle size analyses. Particle size distribution curves and volume population graphs were prepared for these silver powders and for glass powders with optimum, extra fine and coarse particle sizes. The viscosity at a given shear rate and slope of viscosity over a range of shear rates were determined for thick film pastes made with these powders. Because of particle anomalies and variations, the need for flexibility to achieve the best printing qualities for silver pastes was evident. It was established that print quality, dried and fired film density and optimum contact of silver particles with silicon, important for cell electrical output, could be achieved by adjusting the slope of viscosity that fell outside of the range, -0.550 to -0.650. This was accomplished through organic vehicle technology that permitted a change in the slope of viscosity, up or down, while maintaining a constant silver and total solids content. Author

**N84-21993*#** Spectrolab, Inc., Sylmar, Calif.
**NON-NOBLE METAL BASED METALLIZATION SYSTEMS**
Alexander Garcia, III *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 215-240 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

The results of efforts to produce a nonsilver metallization system for silicon photovoltaic cells are given. The system uses a metallization system based on molybdenum, tin, and titanium hydride. The initial work in this system was done using the MIDFILM process. The MIDFILM process attains a line resolution comparable to photoresist methods with a process related to screen printing. The surface to be processed is first coated with a thin layer of photopolymer material. Upon exposure to ultraviolet light through a suitable mask, the polymer in the non-pattern area crosslinks and becomes hard. The unexposed pattern areas remain tacky. The conductor material is then applied in the form of a dry mixture of metal which adheres to the tacky pattern area. The assemblage is then fired to ash the photopolymer and sinter the conductor powder. R.J.F.

**N84-21994*#** Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
**POLYMER THICK-FILM CONDUCTORS AND DIELECTRICS FOR MEMBRANE SWITCHES AND FLEXIBLE CIRCUITRY**
N. Nazarenko *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 241-261 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

The fabrication and operation of membrane switches are discussed. The membrane switch functions as a normally open, momentary contact, low-voltage pressure-sensitive device. Its design is a three-layer sandwich usually constructed of polyester film. Conductive patterns are deposited onto the inner side of top and bottom sheets by silk screening. The center spacer is then placed between the two circuit layers to form a sandwich, generally held together by an adhesive. When pressure is applied to the top layer, it flexes through the punched openings of the spacer to establish electrical contact between conductive pads of the upper and lower sheets, momentarily closing the circuit. Upon release of force the top sheet springs back to its normal open position. The membrane touch switch is being used in a rapidly expanding range of applications, including instrumentation, appliances, electronic games and keyboards. Its board acceptance results from its low cost, durability, ease of manufacture, cosmetic appeal and design flexibility. The principal electronic components in the membrane switch are the conductor and dielectric. R.J.F.

**N84-21995*#** Eaton Corp., Beverly, Mass. Ion Materials Systems.
**IONIZED CLUSTER BEAM DEPOSITION**
Allen R. Kirkpatrick *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 265-276 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Ionized Cluster Beam (ICB) deposition, a new technique originated by Takagi of Kyoto University in Japan, offers a number of unique capabilities for thin film metallization as well as for deposition of active semiconductor materials. ICB allows average energy per deposited atom to be controlled and involves impact kinetics which result in high diffusion energies of atoms on the growth surface. To a greater degree than in other techniques, ICB involves quantitative process parameters which can be utilized to strongly control the characteristics of films being deposited. In the ICB deposition process, material to be deposited is vaporized into a vacuum chamber from a confinement crucible at high temperature. Crucible nozzle configuration and operating temperature are such that emerging vapor undergoes supercondensation following adiabatic expansion through the nozzle. R.J.F.

**N84-21996*#** Purdue Univ., Lafayette, Ind.
**METALLIZATION WITH GENERIC METALLO-ORGANIC INKS**
Geraldine M. Vest *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 277-300 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

The use and fabrication of metallo-organic films are discussed. Metallo-organic compounds are ones in which a metal is linked to a long chain carbon ligand through a hetero atom such as O, S, N, P or As. Films formed by the thermal decomposition of these metallo-organics are called MOD films. In order that the products of decomposition contain only CO2, H2O, and in rare cases nitrogen compounds, and to avoid S containing products, the use of a set of metallo-organic compounds for ink fabrication where the linking hetero atom was oxygen was pioneered. These links were made from commercially available carboxylates, or synthesized from commonly available reagents. The processing is described and the molecular design criteria are given. The particular carboxylates or amine carboxylates selected were the octoates or neodecanoates, and they are described. R.J.F.

**N84-21997*#** VEECO Instruments, Plainview, N.Y.
**DRY ETCHING OF METALLIZATION**
David Bollinger *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 301-316 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

The production dry etch processes are reviewed from the perspective of microelectronic fabrication applications. The major dry etch processes used in the fabrication of microelectronic devices can be divided into two categories - plasma processes in which samples are directly exposed to an electrical discharge, and ion beam processes in which samples are etched by a beam of ions extracted from a discharge. The plasma etch processes can be distinguished by the degree to which ion bombardment contributes to the etch process. This, in turn is related to capability for anisotropic etching. Reactive Ion Etching (RIE) and Ion Beam Etching are of most interest for etching of thin film metals. RIE is generally considered the best process for large volume, anisotropic aluminum etching. R.J.F.

**N84-21998*#** Westinghouse Research and Development Center, Pittsburgh, Pa.
**LASER ASSISTED DEPOSITION**
Subhadra Dutta *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 317-332 refs (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Applications of laser-based processing techniques to solar cell metallization are discussed. Laser-assisted thermal or photolytic maskless deposition from organometallic vapors or solutions may provide a viable alternative to photovoltaic metallization systems currently in use. High power, defocused excimer lasers may be used in conjunction with masks as an alternative to direct laser writing to provide higher throughput. Repeated pulsing with excimer lasers may eliminate the need for secondary plating techniques for metal film buildup. A comparison between the thermal and photochemical deposition processes is made. R.J.F.

**N84-21999*#** Pennsylvania State Univ., University Park.
**TRANSPARENT CONDUCTIVE COATINGS**
S. Ashok *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 335-363 refs (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

Thin film transparent conductors are discussed. Materials with electrical conductivity and optical transparency are highly desirable in many optoelectronic applications including photovoltaics. Certain binary oxide semiconductors such as tin oxide (SnO2) and indium oxide (In2O3) offer much better performance tradeoff in optoelectronics as well as better mechanical and chemical stability than thin semitransparent films. These thin-film transparent conductors (TC) are essentially wide-bandgap degenerate semiconductors - invariably n-type - and hence are transparent to sub-bandgap (visible) radiation while affording high electrical conductivity due to the large free electron concentration. The

principal performance characteristics of TC's are, of course, electrical conductivity and optical transmission. The TC's have a refractive index of around 2.0 and hence act as very efficient antireflection coatings. For using TC's in surface barrier solar cells, the photovoltaic barrier is of utmost importance and so the work function or electron affinity of the TC is also a very important material parameter. Fabrication processes are discussed. R.J.F.

**N84-22000*#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**IRON-COPPER METALLIZATION FOR FLEXIBLE SOLAR/CELL ARRAYS**
Henry W. Lavendel *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 375-394 (For primary document see N84-21980 12-44)
Avail: NTIS HC A16/MF A01 CSCL 10A

The feasibility of a copper-base metallization for shallow-junction cells applied in flexible solar arrays in space is discussed. This type of metallization will reduce usage of precious metals (such as silver), increase case of bonding (by welding or by soldering) and eliminate heavy high Z interconnects (such as molybdenum). The main points of concern are stability against thermally induced diffusion of copper into silicon which causes degradation of shallow cell junctions, and low series resistance of the contact with semiconductor which promotes cell efficiency. R.J.F.

**N84-22001*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**AN ASSESSMENT OF ADVANCED TECHNOLOGY FOR INDUSTRIAL COGENERATION Report, Nov. 1982 - May 1983**
N. Moore Jun. 1983 139 p refs
(Contract NAS7-918; NASA Order C-2742911)
(NASA-CR-173456; JPL-Pub-83-66; NAS 1.26:173456) Avail: NTIS HC A07/MF A01 CSCL 10B

The potential of advanced fuel utilization and energy conversion technologies to enhance the outlook for the increased use of industrial cogeneration was assessed. The attributes of advanced cogeneration systems that served as the basis for the assessment included their fuel flexibility and potential for low emissions, efficiency of fuel or energy utilization, capital equipment and operating costs, and state of technological development. Over thirty advanced cogeneration systems were evaluated. These cogeneration system options were based on Rankine cycle, gas turbine engine, reciprocating engine, Stirling engine, and fuel cell energy conversion systems. The alternatives for fuel utilization included atmospheric and pressurized fluidized bed combustors, gasifiers, conventional combustion systems, alternative energy sources, and waste heat recovery. Two advanced cogeneration systems with mid-term (3 to 5 year) potential were found to offer low emissions, multi-fuel capability, and a low cost of producing electricity. Both advanced cogeneration systems are based on conventional gas turbine engine/exhaust heat recovery technology; however, they incorporate advanced fuel utilization systems. Author

**N84-22002*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**NASA FLIGHT ELECTRONICS ENVIRONMENTAL STRESS SCREENING SURVEY**
Edward J. Marian, comp. 1 Dec. 1983 40 p refs Sponsored by NASA
(NASA-CR-173472; JPL-Pub-83-76; NAS 1.26:173472) Avail: NTIS HC A03/MF A01 CSCL 10A

Data compiled by the Institute of Environmental Sciences were used to establish guidelines for identifying defective, abnormal, or marginal parts as well as manufacturing defects. These data are augmented with other available sources of similar information in conjunction with NASA centers' data and presented in a form that may be useful to all NASA centers in planning and developing effective environmental stress screens. Information relative to thermal and vibration screens as the most effective methods for surfacing latent failures in electronic equipment at the component level is considered. A.R.H.

**N84-22003*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**A SURVEY OF GAS-SIDE FOULING IN INDUSTRIAL HEAT-TRANSFER EQUIPMENT Final Report**
W. J. Marner and J. W. Suitor Nov. 1983 168 p refs Sponsored in cooperation with DOE
(Contract NAS7-918)
(NASA-CR-173469; JPL-Pub-83-74; NAS 1.26:173469) Avail: NTIS HC A08/MF A01 CSCL 10B

Gas-side fouling and corrosion problems occur in all of the energy intensive industries including the chemical, petroleum, primary metals, pulp and paper, glass, cement, foodstuffs, and textile industries. Topics of major interest include: (1) heat exchanger design procedures for gas-side fouling service; (2) gas-side fouling factors which are presently available; (3) startup and shutdown procedures used to minimize the effects of gas-side fouling; (4) gas-side fouling prevention, mitigation, and accommodation techniques; (5) economic impact of gas-side fouling on capital costs, maintenance costs, loss of production, and energy losses; and (6) miscellaneous considerations related to gas-side fouling. The present state-of-the-art for industrial gas-side fouling is summarized by a list of recommendations for further work in this area. A.R.H.

**N84-22004*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**JPL TESTS OF A LAJET CONCENTRATOR FACET**
E. W. Dennison and M. J. Argoud 15 Nov. 1983 17 p Sponsored by NASA
(Contract DE-AT04-81AL-16228)
(NASA-CR-173470; JPL-Pub-83-92; JPL-5105-125; DOE/JPL-1060/64; NAS 1.26:173470) Avail: NTIS HC A02/MF A01 CSCL 10A

A LaJet Energy Company (LEC) concentrator facet, 60 in. in diameter, was tested for imaging quality. The following two methods were used: (1) autofocus tests with a point source of light at the facet's radius of curvature; and (2) tests with the Sun close to the horizon as a distant source. The tests of the LaJet facet indicate that all of the solar image reflected by an LEC 460 solar concentrator made of like facets should fall within a 9-in. aperture if the outer facets are carefully adjusted. Such a concentrator would have acceptable performance, but complete evaluation must be made with an assembled concentrator. E.A.K.

**N84-22005*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ADVANCED COGENERATION RESEARCH STUDY: EXECUTIVE SUMMARY**
S. Bluhm, N. Moore, L. Rosenberg, and M. Slonski Jun. 1983 21 p Sponsored by NASA and Southern California Edison Co.
(NASA-CR-173467; JPL-Pub-83-67; NAS 1.26:173467) Avail: NTIS HC A02/MF A01 CSCL 10B

This study provides a broad based overview of selected areas relevant to the development of a comprehensive Southern California Edison (SCE) advanced cogeneration project. The areas studied are: (1) Cogeneration potential in the SCE service territory; (2) Advanced cogeneration technologies; and (3) Existing cogeneration computer models. An estimated 3700 MW sub E could potentially be generated from existing industries in the Southern California Edison service territory using cogeneration technology. Of this total, current technology could provide 2600 MW sub E and advanced technology could provide 1100 MW sub E. The manufacturing sector (SIC Codes 20-39) was found to have the highest average potential for current cogeneration technology. The mining sector (SIC Codes 10-14) was found to have the highest potential for advanced technology. B.W.

**N84-22006*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**COGENERATION COMPUTER MODEL ASSESSMENT: ADVANCED COGENERATION RESEARCH STUDY**
L. Rosenberg Jun. 1983 43 p refs Sponsored in part by the Southern California Edison Co.

(Contract NAS7-918)
(NASA-CR-173453; JPL-Pub-83-59; NAS 1.26:173453) Avail: NTIS HC A03/MF A01 CSCL 10B

Cogeneration computer simulation models to recommend the most desirable models or their components for use by the Southern California Edison Company (SCE) in evaluating potential cogeneration projects was assessed. Existing cogeneration modeling capabilities are described, preferred models are identified, and an approach to the development of a code which will best satisfy SCE requirements is recommended. Five models (CELCAP, COGEN 2, CPA, DEUS, and OASIS) are recommended for further consideration. E.A.K.

**N84-22007*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**SURVEY OF COGENERATION: ADVANCED COGENERATION RESEARCH STUDY**
Marie L. Slonski Jun. 1983 59 p Sponsored in part by the Southern California Edison Co.
(Contract NAS7-918)
(NASA-CR-173454; JPL-Pub-83-40A; NAS 1.26:173454) Avail: NTIS HC A04/MF A01 CSCL 10B

The consumption of electricity, natural gas, or fuel oil was surveyed. The potential electricity that could be generated in the SCE service territory using cogeneration technology was estimated. It was found that an estimated 3700 MWe could potentially be generated in Southern California using cogenerated technology. It is suggested that current technology could provide 2600 MWe and advanced technology could provide 1100 MWe. Approximately 1600 MWt is considered not feasible to produce electricity with either current or advanced cogeneration technology. E.A.K.

**N84-22008*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**CHEMICAL BONDING TECHNOLOGY FOR TERRESTRIAL PHOTOVOLTAIC MODULES**
D. R. Coulter, E. F. Cuddihy, and E. P. Plueddeman 15 Nov. 1983 62 p refs Sponsored in part by DOE
(Contract DE-AI01-76ET-20356)
(NASA-CR-173460; JPL-5101-232; JPL-Pub-83-86; DOE/JPL-1012/91; NAS 1.26:173460) Avail: NTIS HC A04/MF A01 CSCL 10A

Encapsulated photovoltaic modules must hold together for 20 years, reliably resisting delamination and separation of any of the component materials. Delamination of encapsulation materials from each other, or from solar cells and interconnects, can create voids for accumulation of water, promoting corrosive failure. Delamination of silicone elastomers from unprimed surfaces was a common occurrence with early modules, but the incidences of silicone delamination with later modules decreased when adhesion promoters recommended by silicone manufacturers were used. An investigation of silicone delamination from unprimed surfaces successfully identified the mechanism, which was related to atmospheric oxygen and moisture. This early finding indicated that reliance on physical bonding of encapsulation interfaces for long life in an outdoor environment would be risky. For long outdoor life, the material components of a module must therefore be held together by weather-stable adhesion promoters that desirably form strong, interfacial chemical bonds. B.W.

**N84-22009*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PHOTOVOLTAIC POWER CONDITIONING SUBSYSTEM: STATE OF THE ART AND DEVELOPMENT OPPORTUNITIES**
S. Krauthamer, K. Bahrami, R. Das, T. Macie, and W. Rippel 15 Jan. 1984 187 p refs Sponsored in part by DOE
(Contract DE-AI01-76ET-20356)
(NASA-CR-173458; JPL-5220-21; JPL-Pub-83-81; NAS 1.26:173458; DOE/ET-20356-9) Avail: NTIS HC A09/MF A01 CSCL 10A

Photovoltaic systems, the state of the art of power conditioning subsystem components, and the design and operational interaction between photovoltaic systems and host utilities are detailed in this document. Major technical issues relating to the design and development of power conditioning systems for photovoltaic application are considered; these include: (1) standards, guidelines, and specifications; (2) cost effective hardware design; (3) impact of advanced components on power conditioning development; (4) protection and safety; (5) quality of power; (6) system efficiency; and (7) system integration with the host utility. Theories of harmonic distortion and reactive power flow are discussed, and information about power conditioner hardware and manufacturers is provided. E.A.K.

**N84-22010*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**SOLAR TESTS OF APERTURE PLATE MATERIALS FOR SOLAR THERMAL DISH COLLECTORS**
L. D. Jaffe 15 Aug. 1983 79 p refs Sponsored in part by DOE
(Contract DE-AT04-81AL-16228)
(NASA-CR-173462; JPL-5105-121; JPL-Pub-83-68; DOE/JPL-1060/62; NAS 1.26:173462) Avail: NTIS HC A05/MF A01 CSCL 10A

In parabolic dish solar collectors, walk-off of the spot of concentrated sunlight is a hazard if a malfunction causes the concentrator to stop following the Sun. Therefore, a test program was carried out to evaluate the behavior of various ceramics, metals, and polymers under solar irradiation of about 7000 kW/sq m. (peak) for 15 minutes. The only materials that did not slump or shatter were two grades of medium-grain extruded graphite. High purity, slip-cast silica might be satisfactory at somewhat lower flux. Oxidation of the graphite appeared acceptable during tests simulating walk-off, acquisition (2000 cycles on/off Sun), and spillage (continuous on-Sun operation). Author

**N84-22011*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PUBLICATIONS OF THE JPL SOLAR THERMAL POWER SYSTEMS PROJECT, 1976 TO 1983**
V. Gray, comp., C. Marsh, comp., and P. Panda, comp. 1 Jan. 1984 63 p Sponsored in part by DOE
(NASA-CR-173464; DOE/JPL-1060/67; JPL-5105-131; JPL-Pub-84-1; NAS 1.26:173464) Avail: NTIS HC A04/MF A01 CSCL 10A

The bibliographical listings in this publication are documentation products associated with the solar thermal power system project carried out by the Jet Propulsion Laboratory from 1976 to 1983. Documents listed are categorized as conference and journal papers, JPL external reports, JPL internal reports, or contractor reports. Alphabetical listings by title were used in the bibliography itself to facilitate location of the document by subject. Two indexes are included for ease of reference: one, an author index; the other, a topical index. E.A.K.

**N84-22012*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ECUT: ENERGY CONVERSION AND UTILIZATION TECHNOLOGIES PROGRAM. HETEROGENEOUS CATALYSIS MODELING PROGRAM CONCEPT**
G. E. Voecks 15 Aug. 1983 23 p refs Sponsored in part by DOE
(Contract DE-AI01-81CS-66001)
(NASA-CR-173463; DOE/CS-66001/2; JPL-Pub-83-89; NAS 1.26:173463) Avail: NTIS HC A02/MF A01 CSCL 10A

Insufficient theoretical definition of heterogeneous catalysts is the major difficulty confronting industrial suppliers who seek catalyst systems which are more active, selective, and stable than those currently available. In contrast, progress was made in tailoring homogeneous catalysts to specific reactions because more is known about the reaction intermediates promoted and/or stabilized by these catalysts during the course of reaction. However, modeling heterogeneous catalysts on a microscopic scale requires compiling and verifying complex information on reaction intermediates and pathways. This can be achieved by adapting homogeneous catalyzed reaction intermediate species, applying theoretical

quantum chemistry and computer technology, and developing a better understanding of heterogeneous catalyst system environments. Research in microscopic reaction modeling is now at a stage where computer modeling, supported by physical experimental verification, could provide information about the dynamics of the reactions that will lead to designing supported catalysts with improved selectivity and stability. Author

**N84-22013#** Citizens for Community Improvement, Council Bluffs, Iowa.
**WIND ELECTRIC GENERATOR PROJECT Final Report**
23 Sep. 1983 36 p
(Contract DEFG47-80R-701109)
(DE84-006747; DOE/R7-01109/T1) Avail: NTIS MF A01

A wind generator was installed and connected at Iowa Western Community College. It is heating water through four hot water tanks and proved to be an excellent demonstration project for the community. The college gets frequent inquiries about the windmill and has been very cooperative in informing the public about the success. The windmill generates more electricity than is needed to heat four hot water heaters and future plans are to hook up more. The project requires very little maintenance. DOE

**N84-22014#** Harvard Univ., Cambridge, Mass.
**OPTIMIZATION OF TRANSPARENT ELECTRODE FOR SOLAR CELL AND CHEMICAL VAPOR DEPOSITION OF AMORPHOUS SILICON Final Technical Report, 15 Sep. 1980 - 30 Mar. 1983**
Roy G. Gordon, James Proscia, Frank Ellis, and Sarah Kurtz 1983 30 p
(Contract DE-AC02-77CH-00178)
(DE83-017780; SERI/TR-9318-2-T1) Avail: NTIS HC A03/MF A01

A process for deposition fluorine doped tin oxide films was optimized. Further optimization of the transparent electrode films was accomplished, with increasing substrate temperature identified as a primary variable for obtaining better films. Film growth rates were determined as a function of reactant concentrations. A sensitive and reliable method for measuring the interfacial or contact resistance between tin oxide and silicon was developed. Structures were tested, which incorporate a layer of highly doped, electrically conductive titanium oxide between the tin oxide and the silicon. The structures showed much lower contact resistances. Electrical and optical properties were found to be similar to those of amorphous silicon produced by glow discharge. The optical band gaps of the CVD material were slightly smaller than glow discharge a-Si of the same hydrogen content. Doping the CVD films during growth with boron or phosphorous produces conductivities on the order of 300 (UC OMEGA)-cm. Schottky diode cells with a structure stainless steel/n-Si/i-Si/Pt show an efficiency of about 3%, after correction for the transmission of the platinum layer. DOE

**N84-22015#** Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
**MATERIALS AND CELLS FOR HIGH-EFFICIENCY SOLAR-TO-ELECTRIC CONVERSION**
John P. Benner Jun. 1983 5 p refs Presented at the 18th Intersoc. Energy Conversion Eng. Conf., Orlando, Fla., 21 Aug. 1983
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(DE83-011961; SERI/TP-211-1988; CONF-830812-27) Avail: NTIS HC A02/MF A01

Research on high efficiency solar cells is gaining increased attention. This interest results from economic studies which show the value of attaining higher performance and improvements from the laboratory which suggest that very high efficiencies can be achieved. The recent progress in research on new materials and cell designs which offer potential for achieving very high photovoltaic conversion efficiencies are reviewed. DOE

**N84-22016#** Midwest Research Inst., Golden, Colo. Thermal Systems and Engineering Branch.
**LOW-TEMPERATURE IPH PARABOLIC TROUGHS: DESIGN VARIATIONS AND COST-REDUCTION POTENTIAL**
Randy C. Gee Nov. 1983 37 p refs
(Contract DE-AC02-83CH-10093)
(DE84-000024; SERI/TR-253-1662) Avail: NTIS HC A03/MF A01

Parabolic trough concentrating collectors which have improved in performance and reliability and development of its components which was tailored to meeting instantaneous collector performance goals at an operating temperature of 315(0)C (600(0)F) are discussed. Although this strategy resulted in advanced component designs and excellent collector performance at 315(0)C, it has also necessitated stringent, expensive component design requirements. Near term parabolic trough collector systems are too expensive to compete widely with conventional fossil fuel systems. The reduction of collector costs with lower temperature designs is described. Industrial process heating energy use at below 150(0)C (300(0)F) is over five times greater than that at from 200(0) to 315(0)C (400(0)F to 600(0)F). Component designs for lower temperatures are considered, including less rigid, lighter weight concentrators; alternative concentrator constructions; larger receivers; and multiple row drive systems. DOE

**N84-22017#** Chicago Univ., Ill. Solar Energy Group.
**DESIGN OPTIMIZATION STUDIES FOR NONIMAGING CONCENTRATING SOLAR COLLECTOR TUBES Final Technical Report**
Roland Winston and Joseph J. OGallagher 30 Sep. 1983 62 p refs
(Contract DE-AC03-82SF-11655)
(DE84-001368; DOE/SF-11655/T1) Avail: NTIS HC A04/MF A01

The Integrated Stationary Evacuated Concentrator or ISEC solar collector panel which achieved the best high temperature performance ever measured with a stationary collector was examined. A development effort review and optimize the initial proof of concept design was completed. Changes in the optical design to improve the angular response function and increase the optical efficiency were determined. A recommended profile design with a concentration ratio of 1.55x and an acceptance angle of + - 35(0) was identified. Two alternative panel/module configurations are recommended based on the preferred double ended flow through design. Parasitic thermal and pumping losses show to be reducible to acceptable levels, and two passive approaches to the problem of ensuring stagnation survival are identified. DOE

**N84-22018#** Midwest Research Inst., Golden, Colo. Solar Electric Conversion Research Div.
**OSCILLATING WIND ENERGY CONVERSION SYSTEMS**
Peter South and Richard Mitchell Dec. 1983 23 p refs
(Contract DE-AC02-83CH-10093)
(DE84-000087; SERI/TR-211-1911) Avail: NTIS HC A02/MF A01

The oscillating cable type wind energy conversion system and the oscillating vane and the oscillating wind are addressed. The advantages and disadvantages of each type of system are evaluated, and each is compared with a conventional rotating element wind energy conversion device. It appears unlikely that any of the oscillating element concepts can compete with the present generation of conventional wind energy systems. DOE

**N84-22019#** New Alchemy Inst., Woods Hole, Mass.
**MATCHING WIND TURBINE ROTORS AND LOADS: COMPUTATIONAL METHODS FOR DESIGNERS**
Joseph B. Seale Apr. 1983 191 p refs
(Contract DE-AC04-76DP-03533)
(DE84-006921; RFP-3423) Avail: NTIS HC A09/MF A01

A comprehensive method for matching wind energy conversion system (WECS) rotors with the load characteristics of common electrical and mechanical applications was reported. A method was developed to convert the data into useful results: (1) from turbine efficiency and load torque characteristics, turbine power is predicted as a function of windspeed; (2) it is decided how turbine power is to be governed to insure safety of all components; (3)

mechanical conversion efficiency comes into play to predict how useful delivered power varies with windspeed; (4) wind statistics are used to predict longterm energy output. Most systems are approximated by a graph and calculator approach. The method leads to energy predictions, and to insight into modeled processes. A computer program provides more sophisticated calculations where a highly unusual system is to be modeled, where accuracy is at a premium, or where error analysis is required. The analysis is fleshed out with in depth case studies for induction generator and inverter utility systems; battery chargers; resistance heaters; positive displacement pumps; including three different load compensation strategies; and centrifugal pumps with unregulated electric power transmission from turbine to pump. DOE

**N84-22020#** Sandia Labs., Albuquerque, N. Mex.
**FIELD EXPERIENCE WITH VOLTAGE BREAKDOWN IN PHOTOVOLTAIC (PV) ARRAYS**
T. D. Harrison and J. P. Fernandez (New Mexico Univ.) 1983 5 p refs
(Contract DE-AC04-76DP-00789)
(DE84-005551; SAND-83-2324C) Avail: NTIS HC A02/MF A01

Information about voltage breakdown of photovoltaic arrays in the field was obtained array sites. The arrays were located at Beverly High School, Lovington Square Shopping Center, Newman Power Station, and the Oklahoma Center for Sciences and Arts. No breakdowns are reported for these sites. Breakdowns at other sites which are attributed to burrs on washers piercing insulation in one instance and delamination of a metal frame causing a short circuit in another are discussed. Other problems not attributable to voltage breakdown are also discussed. DOE

**N84-22021#** ICF, Inc., Washington, D. C.
**ECONOMIC ASSESSMENT OF NINE GEOTHERMAL DIRECT USE APPLICATIONS Final Report**
Laura Cohen Gordon and Theodore R. Breton Dec. 1983 101 p refs
(Contract DE-AC07-80ID-12099)
(DE84-006475; DOE/ET-12099/5) Avail: NTIS HC A06/MF A01

An economic analysis of nine federally supported geothermal direct heat applications which were part of DOE's Program Opportunity Notice (PON) program is reported. Three of the projects were user owned systems, and six were district heating systems. Five of the nine projects are successful from an economic standpoint and the majority of these projects are in areas where geothermal energy has long been used for heating. It is indicated that geothermal energy projects can be economic under certain conditions, but these conditions may not be very widespread. DOE

**N84-22022#** Florida Solar Energy Center, Cape Canaveral.
**PERFORMANCE MONITORING OF ACTIVE SOLAR ENERGY SYSTEMS**
Marvin Yarosh, ed. Jun. 1983 374 p refs Presented at the 2nd Natl. Workshop on Performance Monitoring of Active Solar Energy Systems, Cape Canaveral, Fla., 20-21 Jan. 1983
(Contract DE-AC02-83CH-10093)
(DE84-000027; SERI/CP-281-2173; CONF-830124; FSEC-CR-78-83(EI)) Avail: NTIS HC A16/MF A01

Performance monitoring of active solar systems was conducted both in the field and under more controlled conditions in the laboratory. The merits of testing systems in the field and testing systems in the laboratory were discussed. It was agreed that both types of testing are needed, but substantial disagreement on the value of a particular kind of test to meet a specific need. Field monitoring as the only method to determine what is being delivered in the field was supported and mixed views were expressed on the perferred method for model validation and on the trustworthiness of laboratory versus field data. The value of different levels of sophistication of instrumentation were discussed. The quality of the data obtained, the cost of such data and the tradeoffs in cost, quality and reliability for differing instrumentation and data acquisition systems were addressed. It is suggested that the potential for system performance improvement lays more strongly in the development of greater reliability rather than through improvements in thermal performance. DOE

**N84-22023#** Rockwell International Corp., Golden, Colo. Wind Energy Research Center.
**SMALL WIND SYSTEMS FIELD EVALUATION. VOLUME 1: EXECUTIVE SUMMARY AND PROGRAM DESCRIPTION Final Report**
Darrell M. Dodge and Craig Liske Jul. 1983 147 p refs 4 Vol.
(Contract DE-AC04-76DP-03533)
(DE84-006916; RPF-3562/1) Avail: NTIS HC A07/MF A01

The operation, management, and results of the field evaluation program (FEP) for small wind systems, is described. The FEP initiated to install wind systems in the states and territories to assist local governments in evaluating and addressing the institutional concerns associated with the proliferation of small wind systems in utility interconnected applications. An executive summary of the program, together with a description of the program's development and implementation is provided. Installation sites and users were selected, and local utilities were involved in the program. It is concluded that single wind systems has very few effects on utility operations, but local zoning requirements posed a potentially severe institutional barrier. The planning and conduct of technology evaluation programs are outlined. DOE

**N84-22024#** Rockwell International Corp., Golden, Colo. Energy Systems Group.
**SMALL WIND SYSTEMS FIELD EVALUATION. VOLUME 2: INSTITUTIONAL ISSUES Final Report**
Darrell M. Dodge and Craig Liske Jul. 1983 92 p refs 4 Vol.
(Contract DE-AC04-76DP-03533)
(DE84-006913; RPF-3562/2) Avail: NTIS HC A05/MF A01

The operation, management, and results of the field evaluation program (FEP) for small wind systems is described. The FEP was initiated in early 1979 with the objective to install wind systems in the states and territories to assist local governments in evaluating and addressing the institutional concerns associated with the proliferation of small wind systems in utility interconnected applications. Institutional issues defined, encountered and addressed by Rocky Flats in operating the FEP are summarized. Information dissemination, which includes briefings of state and local governments and utility personnel is outlined. The scope and acievements of the program are detailed. Specific problems encountered and addressed are described which includes height restrictions posed by proximity to airports and requirements for state and local approvals of various types. Other barriers include lack of public knowledge, lack of data sources, local wind resource uncertainties, lack of industry standards, and low institutional and consumer confidence. Regulatory barriers which would impact other federal projects and large private wind farm development efforts are considered. DOE

**N84-22025#** Stuttgart Univ. (West Germany). Inst. fuer Theorie der Elekrotechnik.
**TECHNICAL APPLICATIONS OF SOLAR ENERGY. PROJECT PHOTOVOLTAIC SYSTEMS AND PROJECT SELECTIVE COATINGS Final Report, Feb. 1982**
Karlhanns Gindele, Karl Honstetter, Hans Karl, Michael Koehl, Guenther Lehner, Martin Mast, Christian Spohn, and Andreas Wagner Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 90 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-83-299; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 19

Long time stability of photovoltaic generators, hybrid collectors, and measuring devices for solar cells and solar cell generators were investigated. No aging of electrical features is stated after 6 yr working, while thermal and electrical efficiencies of collectors amount to 70% and 8% respectively. Radiative properties of selective coatings were measured, composition and structure of selective surfaces, vapor deposition methods (e.g., cermet-

coatings), and chemical methods (e.g., cooper-oxide) were investigated. Author (ESA)

**N84-22026#** Puerto Rico Univ., San Juan. Center for Energy and Environment Research.
**DEVELOPMENT OF ALTERNATIVE ENERGY SCIENCE AND ENGINEERING IN THE CARIBBEAN**
Juan A. Bonnet, Jr. and Wallace C. Koehler, Jr. Nov. 1983 17 p Sponsored in part by DOE
(PB84-145648; CEER-X-165) Avail: NTIS HC A02/MF A01 CSCL 10A

A pilot designed to improve the capabilities of Caribbean universities and research institutes in helping solve the energy problems of the region is discussed. Most of the region is almost entirely dependent on imported petroleum to satisfy its energy needs. That dependency has exascerbated economic problems with the escalation of petroleum prices in the past ten years. A potential solution to reduce both the high degree of dependence and economic costs is to develop other energy systems. A project to foster cooperative research efforts to assist in the introduction of alternative energy solutions was developed. A network of scientists and engineers working in energy was established to promote cooperation, interchange of technical information and development of joint projects. Author (GRA)

**N84-21572#** Joint Publications Research Service, Arlington, Va.
**DETAILS OF COSMONAUTS' INSTALLATION OF SOLAR BATTERIES**
V. Vladimirov *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 16-18 Transl. into ENGLISH from Pravda (Moscow), 4 Nov. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

# 45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

**N84-22027#** Virginia Polytechnic Inst. and State Univ., Blacksburg. Lab. for Air Pollution Impact to Agriculture and Forestry.
**RAINFALL CHEMISTRY AND POTENTIAL BENEFICIAL-DETRIMENTAL IMPACT TO INDIGENOUS VEGETATION Final Report, 23 Feb. 1981 - 23 Aug. 1983**
W. E. Winner, B. I. Chevone, A. Chappelka, and J. M. Skelly 23 Aug. 1983 58 p
(Contract DAAG29-81-K-0045)
(AD-A138471; ARO-17823.2-LS) Avail: NTIS HC A04/MF A01 CSCL 06/6

This research project was designed to evaluate the effects of air pollutants on forests in southwestern Virginia. Extensive field studies utilizing tree coring techniques and open-top chamber experiments have shown that air pollutants for RAAP have periodically caused foliar injury to air pollution-sensitive trees and suppressed forest growth. Laboratory studies showed the genetic basis for interspecific differences in air pollution sensitivity and showed pollutants generally caused reductions in transpiration and photosynthesis. Field and laboratory studies carried out between 1974 and 1980 are reviewed in this report. More recent studies have documented patterns of ozone dispersion through the ridge-valley Appalachian Mountains. Higher elevation sites tended to have higher ozone concentrations. Rainfall chemistry has also been characterized for a station in southwestern Virginia. A rainfall simulator has been designed and built in order to reproduce rainfall in controlled laboratory experiments. This simulator provides natural-sized raindrops, distributes droplets evenly over a surface, and is chemically inert. Studies on defining the role of rainfall chemistry and ozone impact on plants are now underway. GRA

**N84-22028#** GCA Corp., Bedford, Mass. Technology Div.
**ACID RAIN INFORMATION BOOK Final Report**
May 1983 402 p refs
(Contract DE-AC01-82EP-12079)
(DE83-013693; GCA-TR-82-86-G) Avail: NTIS HC A18/MF A01

Aspects of the acid rain phenomenon are discussed, areas of uncertainty and current and projected research are summarized. Sources of pollutants affecting acid rain formation to the atmospheric transport and transformation of those pollutants and finally to the deposition of acid rain, the effects of that deposition, and possible mitigative measures and regulatory options are indicated. Uncertainties in the understanding of the acid rain phenomenon and current and proposed research are discussed. DOE

**N84-22029#** Pacific Northwest Lab., Richland, Wash.
**TRAN-STAT STATISTICS FOR ENVIRONMENTAL STUDIES. STATISTICAL DISTRIBUTIONS FOR CONTAMINANT STUDIES, AND THE ESTIMATION OF AVERAGE CONCENTRATIONS Statistics Section.**
Richard O. Gilbert Nov. 1983 30 p refs
(Contract DE-AC06-76RL-01830)
(DE84-006579; PNL-SA-11845) Avail: NTIS HC A03/MF A01

The statistical analysis of environmental contaminant data which invariably involves making assumptions about the statistical distribution of the underlying phenomenon and some of the important properties of two of the most important of these distributions, the normal and lognormal distributions are discussed. Several methods available for estimating the mean and variance of lognormal variates are presented. The sample geometric mean (GM) is shown to be biased for both the mean and median of a lognormal distribution. The bias of the GM depends on the skewness of the lognormal distribution and on the number of data used to compute the GM. It is shown that a facility that emits pollutants could be declared in violation of a standard solely because only a few data were used in computing the GM. The difference between two GM's can also give a distorted estimate of the difference between the two population medians if the number of data used to compute one of the GM's is very small. The estimation of a concentration ratio using the GM of ratios can be biased high if n is small and the variance of the logarithmically transformed ratio (sigma(2)/sub y) is large. DOE

**N84-22030#** National Bureau of Standards, Washington, D.C.
**CHARACTERIZATION OF ACID RAIN FOR SOURCE IDENTIFICATION. TASK 1: SULFUR ISOTOPE RATIONING Final Report**
W. R. Kelly and P. J. Paulsen 1983 60 p refs
(Contract DE-AI22-82PC-53141)
(DE84-006510; DOE/PC-53141/T1) Avail: NTIS HC A04/MF A01

Refining a thermal ionization mass spectrometric procedure for the determination of sulfur isotopic ratios was undertaken. The long range goal is to measure the differences in the (32)S/(34)S ratios in natural samples to identify sources of sulfur impacting on receptor sites. The precision of the technique was evaluated. The new thermal ionization technique for the determination of sulfur isotopic ratios was applied to the measurement of natural samples. The HASP program consists of Project Airstream and Project Ashcan. More than 30 samples from Project Airstream were measured. The following observations are made: (1) the observed range in delta (34)S values is from -35 to +32, this range almost covers the total range commonly observed in terrestrial systems; (2) El Chichon injected sulfur into the stratosphere with delta(34)S value near zero in April 1982. Multiple sources of sulfur or large changes in the (32)S/(34)S ratios are produced as SO2 conversion to SO4(-2) proceeds; and (3) sulfur isotopic data are used to constrain interpretations of sulfur concentration data. E.A.K.

**N84-22031#** Environmental Protection Agency, Research Triangle Park, N.C. Environmental Monitoring Systems Lab.
**PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON RECENT ADVANCES IN POLLUTANT MONITORING OF AMBIENT AIR AND STATIONARY SOURCES**
May 1983 402 p refs Symp. held in Raleigh, N.C., 4-7 May 1982

(PB84-148345; EPA-600/9-83-007) Avail: NTIS HC A18/MF A01 CSCL 07D

Both source emission monitoring and ambient air monitoring were discussed. Included were presentations on gaseous organics, particulate pollutants, and personal monitoring. Also presented were findings relative to sampling and analytical methods as well as to a broad spectrum of organic chemicals in outdoor and indoor air. Author (GRA)

**N84-22032#** American Society of Civil Engineers, New York. Oxygen Transfer Studies Subcommittee.

**DEVELOPMENT OF STANDARD PROCEDURES FOR EVALUATING OXYGEN TRANSFER DEVICES Final Report, Mar. 1978 - Dec. 1980**

W. C. Boyle Oct. 1983 317 p refs

(Grant EPA-R-805868)

(PB84-147438; EPA-600/2-83-102) Avail: NTIS HC A14/MF A01 CSCL 14B

In an effort to obtain consensus standards for the evaluation of aeration devices in both clean and dirty water, the American Society of Civil Engineers (ASCE) established a Subcommittee on Oxygen Transfer Standards. Recommended procedures for testing of oxygen transfer devices in both clean and dirty water are presented. Seven interdependent reports including: (1) modelling and data interpretation, (2) unsteady state clean water tests, (3) effects of wastewater characteristics and temperature on oxygen transfer, (4) oxygen transfer measurements in respiring systems, (5) geometry and mixing considerations, (6) gas flow measurement, and (7) power measurement describe these standards. GRA

# 46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

**N84-22033#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**TIDAL OSCILLATIONS IN THE ATMOSPHERIC SODIUM LAYER**

P. P. Batista, B. R. Clemesha, D. M. Simonich, and V. W. J. H. Kirchhoff Feb. 1984 40 p refs Submitted for publication

(INPE-3008-PRE/454) Avail: NTIS HC A03/MF A01

The vertical distribution of atmospheric sodium produced by diurnal and semidiurnal tides was measured. Average time variations of the sodium density show strong oscillations with 12 and 24 hour periods. Both the diurnal and semidiurnal components of the oscillation display large amplitudes and a 180 deg phase inversion near the layer peak. The propagation of tides in the layer, taking into account the interaction between the tide and the minor constituent layer is outlined. It is shown that the vertical wind is the most important factor which determines the amplitude of the oscillation in sodium density at a fixed height, thus making it possible to estimate the phase and amplitude of the wind oscillations over a limited height range. The 12 hour component shows vertical phase propagation with a wavelength of -50 km. The 24 hour component, however, shows characteristics of an evanescent mode instead of the expected S2,2 mode. Maximum upward vertical velocity occurs at about 2100 LT at all heights for the diurnal component, and at 0600 and 1800 LT at 85km for the semidiurnal component. E.A.K.

**N84-22034#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**THE NIGHT AIRGLOW O2(1-SIGMA) ATMOSPHERIC BAND AT 8645A AND THE ROTATIONAL TEMPERATURE OBSERVED AT 23 DEG S**

H. Takahashi, Y. Sahai, and P. P. Batista Feb. 1984 8 p refs Presented at Intern. Symp. on Equatorial Aeronomy, Mar. 1984

(INPE-3021-PRE/459) Avail: NTIS HC A02/MF A01

The O2 measurements of atmospheric band at 8645A and the rotational temperature together with OI5577A, NaD and OH(9,4) band emissions were recorded. Multichannel tilting filter type photometers were used. The O sub 2 band intensities occasionally vary from 200 Rayleighs to 1000 Rayleighs during a night. Covariations with OI5577A emissions were observed. The rotational temperature determined from the P-branch of the O sub 2 measurement vary between 180 K and 230 K. The amplitude of the nocturnal temperature variations is frequently larger than that derived from the OH emission, and the phase of the variation normally leads that of the OH. It is observed on some nights that the temperature variations of both the emissions are out of phase, which suggests a vertical phase propagation of the atmospheric wavelike perturbations. E.A.K.

**N84-22035#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**VERTICAL AND HORIZONTAL PHASE PROPAGATION IN THE MESOPAUSE REGION OBSERVED BY THE OI5577 ANGSTROM, O/SUB 2 ATMOSPHERIC BAND, NaD AND OH(8,3) BAND NIGHTGLOW EMISSIONS**

H. Takahashi, P. P. Batista, Y. Sahai, and B. R. Clemesha Feb. 1984 8 p refs Presented at the Intern. Symp. on Equatorial Aeronomy, Sao Jose dos Campos (Brazil), Mar. 1984

(INPE-3022-PRE/460) Avail: NTIS HC A02/MF A01

The upper mesospheric and lower thermospheric nightglow OI5577A, O Atmospheric band at 8645A, NaD and OH(8,3) band emissions by multichannel tilting filter type zenith photometers, and the NaD and OH(8,3) band emissions by a meridional scanning photometer were measured simultaneously. The nocturnal intensity variations and the meridional scanning observations show vertical and horizontal phase propagation, respectively, in the emission layers. The observations are presented and the effects of the upper atmosphere tidal wave and gravity wave propagations are discussed. E.A.K.

**N84-22036#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**PLASMA BUBBLE IRREGULARITY OCCURRENCE AND ZONAL VELOCITIES UNDER QUIET AND DISTURBED CONDITIONS, FROM POLARIMETER OBSERVATIONS**

M. A. Abdu, I. S. Batista, J. H. A. Sobral, E. R. dePaula, and I. J. Kantor Feb. 1984 10 p refs Presented at the Intern. Symp. on Equatorial Aeronomy, Sao Jose dos Campos (Brazil), Mar. 1984

(INPE-3023-PRE/461) Avail: NTIS HC A02/MF A01

Amplitude scintillation and Faraday rotation angle fluctuations of satellite VHF beacon registered by electronic polarimeters operated at two magnetically east-west spaced stations 110 km apart were analyzed for equinoctial and summer months of 1982-83, to determine the irregularity patch occurrence characteristics and their zonal velocities under varying levels of magnetic disturbances. The scintillation patch occurrences, and TEC fluctuations representing plasma depletion structures, decreases during premidnight hours, and are enhanced in the postmidnight period, the occurrences often extending to morning hours, with increasing magnetic activity index. While the night events are associated with eastward irregularity patch motion the morning events have westward velocities, reflecting the morning velocity reversal in the F-region bulk plasma motion. The westward plasma bubble motions represent the first observation of this kind. It is shown that the plasma bubble velocity has a tendency to undergo increases immediately following increases in magnetic activity levels. E.A.K.

**N84-22037#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**SOLAR CYCLE RELATED RANGE TYPE SPREAD F OCCURRENCE CHARACTERISTICS OVER EQUATORIAL AND LOW LATITUDE STATIONS IN BRAZIL**

M. A. Abdu, J. H. A. Sobral, O. R. Nelson, and I. S. Batista Feb. 1984 8 p refs Presented at the Intern. Symp. on Equatorial Aeronomy, Sao Jose dos Campos (Brazil), Mar. 1984

(INPE-3024-PRE/462) Avail: NTIS HC A02/MF A01

Range type spread F occurrence rates from sunset to morning hours over Fortaleza and Cachoeira Paulista during the equinoctial month of October. Different occurrence rates were observed at the two stations especially in the early post sunset hours. Over Cachoeira Paulista the spread F occurrence rate at 20 and 21 LT increased by approximately a factor of 3 from low to high sunspot years, and starting from 22-23LT this rate of increase diminished and even showed an inverse dependence with sunspot number towards early morning hours. Fortaleza, the spread F occurrence rate in the early post sunset hours remained very high, 90-100%, during 20-21LT, with no variation from solar minimum to maximum epochs. The spread F occurrence rate is nearly independent of sunspot number remained high up to midnight and fell towards morning hours. The results are interpreted on the basis of the solar activity control on the statistical behavior of plasma bubble vertical rise velocity and F-region dynamo electric field. E.A.K.

**N84-22038#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**LONGITUDINAL EXTENT OF THE CHARACTERISTICS OF THE EQUATORIAL ELECTROJET**

R. P. Kane Feb. 1984 8 p refs Presented at the Intern. Symp. on Equatorial Aeronomy, Sao Jose dos Campos (Brazil), Mar. 1984

(INPE-3027-PRE/465) Avail: NTIS HC A02/MF A01

The geomagnetic H, D, Z patterns at the equatorial locations Huancayo, Peru (75 W) and Ribeirao (48 W) and Eusebio (39 W) were compared. Large longitudinal differences in equatorial electrojet characteristics are noticed, the strength and in the intrusion of Sq systems of one hemisphere into the other. E.A.K.

**N84-22039#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**EQUATORIAL PLASMA BUBBLE EASTWARD VELOCITY CHARACTERISTICS FROM SCANNING AIRGLOW PHOTOMETER MEASUREMENTS OVER CACHOEIRA PAULISTA**

M. A. Abdu, J. H. A. Sobral, and Y. Sahai Feb. 1984 10 p refs Presented at the Intern. Symp. on Equatorial Aeronomy, Sao Jose dos Campos (Brazil), Mar. 1984

(INPE-3026-PRE/464) Avail: NTIS HC A02/MF A01

Airglow depletion patch motion, associated with equatorial plasma bubble events, using east-west and meridional scan OI6300A airglow photometers over Cachoeira Paulista (22 deg 41 S, 45 W, dip -26 deg) in Brazil were observed. It is shown that eastward motion of airglow depletion patches is a regular phenomenon in the postsunset period, extending often to early morning hours (approx. 02 LT), during the summer equinoctial months. Such moving airglow structures were absent during the winter months (June, July and August). The results are: (1) the nighttime mean eastward drift velocities for the months of January to May 1980 are higher than those for the period September 1980 to February 1981; (2) plots of eastward velocity versus local time for the second period mentioned in (1) show decrease of the drift velocity with local time while for the first group the velocity oscillates around an apparently local time independent mean value; and (3) the drift velocities vary in varying degrees with geomagnetic activity index Kp. Measurements of the zonal F-region plasma motions are reported. E.A.K.

**N84-22040#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**LOW LATITUDE F-REGION STUDIES USING THE OI6300 ANGSTROM AND 7744 ANGSTROM NIGHTGLOW MEASUREMENTS AT CACHOEIRA PAULISTA, BRAZIL**

Y. Sahai, H. Takahashi, J. A. Bittencourt, N. R. Teixeira, and J. H. A. Sobral Feb. 1984 8 p refs Presented at the Intern. Symp. on Equatorial Aeronomy, Sao Jose dos Campos (Brazil), Mar. 1984

(INPE-3025-PRE/463) Avail: NTIS HC A02/MF A01

The forbidden OI6300A and the permitted OI7774A nightglow emissions were measured. The long series of the OI6300A emission observations during the ascending phase of the last solar cycle enabled the study of the solar cycle effects and long term variations. The seasonal nocturnal variations show large changes between years of low and high solar activity. Meridional scanning emissions were observed to study propagating disturbances and low latitude F-region dynamics. Salient features of the observations are presented. E.A.K.

**N84-22041#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**THE OCEAN AND THE DYNAMICS OF THE TROPICAL ATMOSPHERE: ITS POSSIBLE PREDICTABILITY**

Antonio Divino Moura Feb. 1984 9 p refs Presented at the Climate Conf. for Latin Am. and the Caribbean, Paipa, Columbia, 28 Nov. - 3 Dec. 1983; sponsored by the World Meteorological Organization

(INPE-2998-PRE/450) Avail: NTIS HC A02/MF A01

The predictability of the tropical atmosphere as compared to the predictability of middle latitude large-scale synoptic flows is discussed. Theoretical and Observational studies and GCM experiments have shown that deterministic predictability for synoptic scale flows is at most one week for the tropics while for middle latitudes it is about two weeks. Although the detailed structures of the instantaneous states of the atmosphere become unpredictable beyond one to two weeks, there seems to be some hope that large-scale features and monthly and seasonal time averages still remain predictable. The slowly varying boundary conditions of sea surface temperature (and anomalies) influence on climate variability in regions of South America is shown for two cases: (1) the flooding conditions in Southern South America and dry conditions over the Amazon region associated with the recent (1982 to 83) El Nino phenomenon, and (2) severe drought occurrences over Northeast Brazil associated with anomalous SST in the tropical Atlantic. Author

**N84-22042#** Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

**OBSERVATIONS OF VLF TRANSMITTER-INDUCED DEPLETIONS OF INNER ZONE ELECTRONS**

A. L. Vampola 9 Dec. 1983 26 p

(Contract F04701-83-C-0084; Grant NSF ATM-77-28187)

(AD-A137982; TR-0084(4940-05)-4; SD-TR-83-89) Avail: NTIS HC A03/MF A01 CSCL 08/14

Precipitation spikes of electrons, in which the energy spread of the peak is narrow (less than 50 keV) and the peak energy is a strong function of the location in L, have been observed in the region $1.5 < L < 2.0$ and have been ascribed to interactions between waves from high power VLF transmitters on the ground and the precipitated electrons. Instrumentation on the S3-2 satellite (polar orbit, 240 km and 1557 km perigee and apogee) included a large geometric factor electron spectrometer which, due to the characteristics of the instrument and orbit, routinely observed these precipitation spikes. Additionally, on numerous occasions when these spikes were observed at low altitude, a significant depletion of electrons at the same energies was observed high on the field line. These depletions indicate that the loss rate of electrons due to VLF transmitters is significant and usually exceeds the rate at which radial diffusion is refilling those field lines. Electrons with energies between 36 and 317 keV in the region $1.9 < L < 1.6$ were observed to have lifetimes limited to a few days by interactions with waves from VLF transmitters. Thus the outer edge of the inner zone is defined by this wave-particle process.

Author (GRA)

**N84-22043*#** National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

**THREE DIMENSIONAL GLOBAL MODELING OF ATMOSPHERIC CO2 Final Technical Report**

I. Fung, J. Hansen, and D. Rind 1983 21 p

(Contract DE-AI01-82ER-60082)

(NASA-TM-85444; NAS 1.15:85444; DE84-005696;

DOE/ER-60082/T1) Avail: NTIS HC A02/MF A01 CSCL 04A

A model was developed to study the prospects of extracting information on carbon dioxide sources and sinks from observed CO2 variations. The approach uses a three dimensional global

transport model, based on winds from a 3-D general circulation model (GCM), to advect CO2 noninteractively, i.e., as a tracer, with specified sources and sinks of CO2 at the surface. The 3-D model employed is identified and biosphere, ocean and fossil fuel sources and sinks are discussed. Some preliminary model results are presented. DOE

**N84-22044#** California Univ., Livermore. Lawrence Livermore Lab.
**COMPARISON OF A SIMPLIFIED VERSION OF TRACKER WITH AN ANALYTIC SOLUTION TO A MODEL RAY TRACING PROBLEM**
R. E. Carlson, J. H. Ellison, and J. A. Levatin Jan. 1984 8 p refs
(Contract W-7405-eng-48)
(DE84-007091; UCID-20004) Avail: NTIS HC A02/MF A01

A 3-D radio ray tracing code called TRACKER was developed. An analytic solution to a radio ray tracing problem which uses a quasi parabolic electron density model with no magnetic field or perturbation was presented. A simplified version of TRACKER was written to solve this problem numerically. It was not possible to compare numerical solutions to analytic solutions for a restricted set of problems. The results of this comparison are presented. The analytic solutions are duplicated to about six significant figures. DOE

**N84-22045#** Los Alamos Scientific Lab., N. Mex.
**STRATOSPHERIC TRITIUM SAMPLING Progress Report, Oct. 1979 - Aug. 1980**
A. S. Mason and H. G. Oestlund (Miami Univ.) Dec. 1983 9 p refs
(Contract W-7405-eng-36)
(DE84-006074; LA-9874-PR) Avail: NTIS HC A02/MF A01

Sampling of tritium gas (HT) and tritiated water vapor (HTO) was conducted as part of Project Airstream. Data were obtained at four altitudes in the upper troposphere and lower stratosphere between the equator and 75 degrees north latitude. The HTO mixing ratios show an overall decrease, with the normal springtime input from higher altitudes superimposed. The HT mixing ratios were essentially constant. DOE

**N84-22046#** Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
**DECONVOLUTION BASED ON SOURCE SCALING APPLIED TO TELESEISMIC SIGNALS**
Hans Israelson Oct. 1983 44 p refs
(FOA-C-20514-T1; ISSN-0347-3694) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm KR25

Source scaling applied to short period teleseismic signals from presumed underground nuclear explosions is discussed. The scaled deconvolution technique, which operates on spectral ratios, separates pairs of recorded signals into source and path records. The technique was tested on recordings of seismic events. A deconvolution algorithm was applied to selected pairs of events, and gave stable results for one subset of the data. The derived source and path records for such a pair of events were used to compute relative source records to the remaining events. Parameters like rise time and delay of the secondary phase were measured for the relative source records. The measured values scale in broad agreement with the cube root of equivalent explosion yield. Author (ESA)

**N84-22047#** Kernforschungsanlage, Juelich (West Germany). Inst. fuer Nukleare Sicherheitsforschung.
**INVESTIGATION OF THE EARTHQUAKE BEHAVIOR OF THE RESEARCH REACTOR FRJ-2 (DIDO) [UNTERSUCHUNG DES ERDBEBENVERHALTENS DES FORSCHUNGSREAKTORS FR-J-2 (DIDO)]**
J. Altes, H. Graffi, and D. Koschmieder Oct. 1983 26 p refs
(JUEL-Spez-222) Avail: NTIS HC A03/MF A01

Finite element calculations were carried out for the reactor FRJ-2 in order to determine its integrity after an earthquake. Results indicate a displacement of 5 mm occurring during 0.25 g safe shutdown earthquake for the reactor block in the horizontal and vertical directions, and 16 mm for the craneway in the horizontal direction, but without danger for the primary circuit. Stresses exceed the yield point in a few structural components. In the case of the tube supports, the rupture point is also exceeded. Since the design contains safety reserves, the integrity of the primary circuit remains assured. Author (ESA)

**N84-21659#** Joint Publications Research Service, Arlington, Va.
**STRUCTURAL FEATURES OF POLYCRYSTALLINE ZnSe AND SOLID SOLUTIONS ZnSe SUB I-X S SUB X Abstract Only**
L. F. Komolova, L. A. Grosheva, L. L. Mukhina, V. V. Sakharov, V. V. Proyanenkov, I. V. Razumovskaya, and N. F. Shevtsova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-84-001) 28 Feb. 1984 p 43-44 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Neorganicheskiye Materialy (Moscow), v. 19, no. 11, Nov. 1983 p 1802-1806 (For primary document see N84-21633 12-23)
Avail: NTIS HC A04/MF A01

**N84-21943*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ATMOSPHERIC EFFECTS ON REMOTE SENSING OF THE EARTH'S SURFACE Abstract Only**
Robert E. Fraser and Y. Kaufman *In its* Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 44 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 04A

**N84-21944*#** EG & G Washington Analytical Services Center, Inc., Riverdale, Md.
**CHARACTERIZATION OF SURFACE REFLECTANCE VARIATION EFFECTS ON REMOTE SENSING Abstract Only**
William A. Pearce *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 45 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 04A

**N84-21945*#** Los Alamos Scientific Lab., N. Mex. Theoretical Div.
**MULTIDIMENSIONAL MODELING OF ATMOSPHERIC EFFECTS AND SURFACE HETEROGENEITIES ON REMOTE SENSING Abstract Only**
Siegfried A. Gerstl *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 46 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 04A

**N84-21946*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**BIDIRECTIONAL SPECTRAL REFLECTANCE OF EARTH RESOURCES: INFLUENCE OF SCENE COMPLEXITY AND ATMOSPHERIC EFFECTS ON REMOTE SENSING Abstract Only**
David J. Diner *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 Mar. 1984 p 47 (For primary document see N84-21929 12-43)
Avail: NTIS HC A12/MF A01 CSCL 04A

**N84-22056*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**REGIONAL CORRELATION BETWEEN TOMS TOTAL OZONE FROM NIMBUS-7 SATELLITE AND GEOPOTENTIAL HEIGHT FROM THE GLAS ANALYSIS**
M.-J. Munteanu, P. Piraino, and E. Kalnay *In its* Res. Rev., 1983 Jan. 1984 p 23-27 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22057*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**COMPARISON OF AMSU TEMPERATURE SOUNDINGS WITH THOSE PRODUCED BY HIRS AND AMTS**

D. Reuter and J. Susskind *In its* Res. Rev., 1983 Jan. 1984 p 28-32 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

**N84-22058*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**WATER VAPOR PROFILE RETRIEVAL SIMULATION STUDIES FOR THE HIRS/MSU AND AMTS/MSU SOUNDERS**
D. Reuter and J. Susskind *In its* Res. Rev., 1983 Jan. 1984 p 33-40 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22059*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**RESULTS OF THE JOINT NASA/NOAA AMTS/HIRS2 SOUNDING SIMULATION TEST**
J. Susskind and D. Reuter *In its* Res. Rev., 1983 Jan. 1984 p 41-44 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22060*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**IMPROVED HIRS2/MSU SOUNDINGS USING TROPOPAUSE INFORMATION**
J. Susskind, M.-J. Munteanu, and P. Piraino *In its* Res. Rev., 1983 Jan. 1984 p 45-48 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22063*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A NEW ALGORITHM FOR TUNING OF COMPUTED RADIANCES FOR HIRS2/MSU**
J. Susskind, P. Piraino, and D. Reuter *In its* Res. Rev., 1983 Jan. 1984 p 60-64 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22064*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE PREDICTION OF TROPOPAUSE HEIGHT FROM CLUSTERS OF BRIGHTNESS TEMPERATURES AND ITS APPLICATION IN THE STRATIFIED REGRESSION TEMPERATURE RETRIEVALS USING MICROWAVE AND INFRARED SATELLITE MEASUREMENTS**
M.-J. Munteanu, P. Piraino, and O. Jakubowicz *In its* Res. Rev., 1983 Jan. 1984 p 65-67 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

**N84-22065*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**APPLICATIONS OF CLUSTER ANALYSIS TO SATELLITE SOUNDINGS**
M.-J. Munteanu, O. Jakubowicz, E. Kalnay, and P. Piraino *In its* Res. Rev., 1983 Jan. 1984 p 68-78 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22066*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EFFECT OF HIGH LATITUDE FILTERING ON NWP SKILL**
E. Kalnay, L. L. Takacs, and R. N. Hoffman *In its* Res. Rev., 1983 Jan. 1984 p 79-86 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22080*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE GROWTH, PROPAGATION AND DECAY OF GLOBAL SCALE ROSSBY WAVES DURING FGGE**
R. S. Lindzen, D. M. Straus, and B. Katz *In its* Res. Rev., 1983 Jan. 1984 p 175-179 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22097*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DEVELOPMENT AND PRELIMINARY TESTS OF A NEW LONG-WAVE RADIATION PARAMETERIZATION**
Harshvardhan, T. Corsetti, D. A. Randall, and M. J. Suarez *In its* Res. Rev., 1983 Jan. 1984 p 251-253 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22098*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SIMULATIONS OF THE STRATOCUMULUS-TOPPED BOUNDARY LAYER WITH A THIRD-ORDER CLOSURE MODEL**
C.-H. Moeng and D. A. Randall *In its* Res. Rev., 1983 Jan. 1984 p 254-256 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22099*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PROBLEMS WITH THE PROCESS PARTITIONING THEORY OF STRATOCUMULUS ENTRAINMENT**
David A. Randall *In its* Res. Rev., 1983 Jan. 1984 p 257-260 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22105*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A NEW PARAMETERIZATION OF 15 MICRON RADIATIVE TRANSFER FOR A GCM**
R. L. Wobus, J. Susskind, and M.-L. C. Wu *In its* Res. Rev., 1983 Jan. 1984 p 292-295 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

**N84-22107*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**IMPACT OF PRESCRIBED DIABATIC HEATING ON SHORT RANGE WEATHER FORECASTS**
L. Marx and J. Shukla *In its* Res. Rev., 1983 Jan. 1984 p 312-322 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

# 47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

**N84-22048** Deutscher Wetterdienst, Offenbach am Main (West Germany).
**REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE, NO. 163. CONTRIBUTION TO THE CLASSIFICATION OF WASTE HEAT WEATHER SITUATIONS BY MEANS OF THERMAL STRATIFICATION. UPPER RHINE MODEL. WASTE HEAT PROJECT, UPPER RHINE, PART 2 [BERICHTE DES DEUTSCHEN XETTERDIENSTES, NR. 163. BEITRAG ZUR KLASSIFIKATION ABWAERMEBEZOGENER WETTERLAGEN MIT HILFEN DER THERMISCHEN CHICHTUNG. MODELLGEBEIT OBERRHEINGRABEN ABWAERMEPROJEKT OBERRHEINGEBEN TEIL 2]**
Gert Suessenguth, Helene Bartels, and Guenter Jurksch 1983 73 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-206-7; ISSN-0072-4130) Copyright. Avail: Issuing Activity

Aerological soundings in the planetary boundary layer carried out during two years are described. Stepwise multiple regression was used to parameterize the thermal stratification by ground measurements and observations of neighboring synoptic stations. By subjective threshold values of cloudiness, visibility, wind velocity, precipitation and thermal stratification two extreme conditions were defined, describing a large spectrum of regional weather situations. After reduction to a time interval of 10 yr, statistics of regional

weather situations were used to provide qualitative climatological estimations of waste heat release. Influence of regionally varying environment were studied by regarding weather types on a synoptic scale. Author (ESA)

**N84-22049*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**RESEARCH REVIEW, 1983**
Jan. 1984 366 p refs
(NASA-TM-86053; NAS 1.15:86053) Avail: NTIS HC A16/MF A01 CSCL 04B

The Global Modeling and Simulation Branch (GMSB) of the Laboratory for Atmospheric Sciences (GLAS) is engaged in general circulation modeling studies related to global atmospheric and oceanographic research. The research activities discussed are organized into two disciplines: Global Weather/Observing Systems and Climate/Ocean-Air Interactions. The Global Weather activities are grouped in four areas: (1) Analysis and Forecast Studies, (2) Satellite Observing Systems, (3) Analysis and Model Development, (4) Atmospheric Dynamics and Diagnostic Studies. The GLAS Analysis/Forecast/Retrieval System was applied to both FGGE and post FGGE periods. The resulting analyses have already been used in a large number of theoretical studies of atmospheric dynamics, forecast impact studies and development of new or improved algorithms for the utilization of satellite data. Ocean studies have focused on the analysis of long-term global sea surface temperature data, for use in the study of the response of the atmosphere to sea surface temperature anomalies. Climate research has concentrated on the simulation of global cloudiness, and on the sensitivities of the climate to sea surface temperature and ground wetness anomalies. For individual titles, see N84-22050 through N84-22113.

**N84-22050*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SIMULATION STUDIES OF PROPOSED OBSERVING SYSTEMS AND THEIR IMPACT ON NUMERICAL WEATHER PREDICTION Abstract Only**
R. Atlas, E. Kalnay, J. Susskind, W. E. Baker, and M. Halem *In its* Res. Rev., 1983 Jan. 1984 p 1 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A series of realistic simulation studies is being conducted as a cooperative effort between the European Centre for Medium Range Weather Forecasts (ECMWF), the National Meteorological Center (NMC), and the Goddard Laboratory for Atmospheric Sciences (GLAS) to provide a quantitative assessment of the potential impact of proposed observation systems on large scale numerical weather prediction. A special objective of this project is to avoid the unrealistic character of earlier simulation studies.
Author

**N84-22051*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EVALUATION OF GLASS MODEL PRECIPITATION FORECASTS FOR NORTH AMERICA DURING SOP-1**
R. Atlas and J. Firestone *In its* Res. Rev., 1983 Jan. 1984 p 2-4 ref (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A study has been made of the accuracy of the GLAS fourth order forecast model's precipitation forecasts over North America during the first Special Observing Period (SOP-1) of FGGE and of the impact of the FGGE special observing systems on these forecasts. Fourteen 120 h predictions were generated using the coarse 4 deg latitude by 5 deg longitude version of the GLAS model from both the FGGE and NOSAT assimilation cycles. These forecasts were then verified against a detailed set of precipitation observations. Separate verifications were performed for precipitation accumulations > or = .01 in., > or = .1 in., and > or = 1 in. occuring in 6, 12 and 24 time periods. In addition, three different methods of verification were applied. In the first method, model precipitation forecasts are verified against the greatest precipitation amount observed within a 4 deg latitude by 5 deg longitude gridbox centered on each gridpoint. For the prediction at a gridpoint to be verified only one observation within the gridbox is required. In the second method, a weighted mean of the closest observations to the gridpoint is used, provided that at least two observations on opposite sides of a gridpoint are available. For the third method, the model precipitation forecasts were interpolated to the observation locations. Author

**N84-22052*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**OBSERVING SYSTEM SIMULATION EXPERIMENTS RELATED TO SPACE-BORNE LIDAR WIND PROFILING. PART 1: FORECAST IMPACTS OF HIGHLY IDEALIZED OBSERVING SYSTEMS Abstract Only**
M. Halem and R. Dlouhy *In its* Res. Rev., 1983 Jan. 1984 p 5 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Simulation experiments comparing the relative importance of an idealized LIDAR wind profiling system with idealized temperature and pressure sounding systems on 12 h forecasts are studied for three 'nature' fields representing the true evolving atmospheric states. The three fields are obtained respectively from: (1) a long integration of the GLAS 4th Order Model (4 deg lat x 5 deg lon x 9 levels), (2) a continuous sequence of NMC operational analysis and, (3) a long integration of the ECMWF high resolution (1.875 deg 1 lat x 1.875 deg lon x 15 layers) operational forecast model. These fields are interpolated to the grid of the GLAS model and used for simulating the observed global analysed fields of winds, temperature, moisture and surface pressure. The same interpolated fields are also used for verification of forecast impact. The effects of clouds, aerosol concentrations, and instrument accuracies on the simulated observation will be discussed. B.W.

**N84-22053*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**OBSERVING SYSTEM SIMULATION EXPERIMENTS RELATED TO SPACE-BORNE LIDAR WIND PROFILING. PART 2: SENSITIVITY TO ATMOSPHERIC AND INSTRUMENTAL INFLUENCES Abstract Only**
R. Dlouhy and M. Halem *In its* Res. Rev., 1983 Jan. 1984 p 6 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Three major potential sources of errors that influence the performance of the proposed LIDAR wind profiling systems are accounted for in the following simulation studies. First, the coherent CO2 laser system proposed by NOAA/ERL for the WINDSAT requires distributions of 10 microns size aerosol concentrations throughout the atmosphere to determine the Doppler shifted backscatter signal. Second, atmospheric influences such as clouds and precipitation affect the LIDAR system's ability to obtain complete vertical wind profiles. In this study, experiments are reported on in which the complete wind profiles are only available in model generated cloud-free regions down to model cloud tops. Third, constraints on the available power required for the expected operational lifetime duration of a LIDAR system govern the number of pulses which can be used to sample a 300 km square area.
B.W.

**N84-22054*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**FGGE DATA IMPACT STUDIES IN THE SOUTHERN HEMISPHERE**
E. Kalnay, R. Atlas, W. E. Baker, and M. Halem *In its* Res. Rev., 1983 Jan. 1984 p 7-13 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The purpose of this paper is to quantify the impact of the FGGE SOS on the GLAS analyses and forecasts in the Southern Hemisphere, and to evaluate the relative importance of its components, and in particular, the impact of the loss of surface buoys. This discussion is limited to the forecast impact of the FGGE system upon a region between 28 deg S and 56 deg S, 50 deg W-80 W which includes essentially the southern cone of

South America. Although forecast skill is verified against the NMC analysis, which used only VTPR but no TIROS-N data in the Southern Hemisphere, enough conventional data exists over this region to avoid biased verifications. B.W.

**N84-22055*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SASS WIND FORECAST IMPACT STUDIES USING THE GLAS AND NEPRF SYSTEMS: PRELIMINARY CONCLUSIONS**
E. Kalnay, R. Atlas, W. E. Baker, D. Duffy, M. Halem, and M. Helfand *In its* Res. Rev., 1983 Jan. 1984 p 14-20 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

For this project, a version of the GLAS Analysis/Forecast System was developed that includes an objective dealiasing scheme as an integral part of the analysis cycle. With this system the (100 sq km) binned SASS wind data generated by S. Peteherych of AER, Canada corresponding of the period 0000 GMT 7 September 1978 to 1200 GMT 13 September 1978 was objectively dealiased. The dealiased wind fields have been requested and received by JPL, NMC and the British Meteorological Office. The first 3.5 days of objectively dealiased fields were subjectively enhanced on the McIDAS system. Approximately 20% of the wind directions were modified, and of these, about 70% were changed by less than 90 deg. Two SASS forecast impact studies, were performed using the dealiased fields, with the GLAS and the NEPRF (Navy Environmental Prediction Research Facility) analysis/forecast systems. B.W.

**N84-22056*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**REGIONAL CORRELATION BETWEEN TOMS TOTAL OZONE FROM NIMBUS-7 SATELLITE AND GEOPOTENTIAL HEIGHT FROM THE GLAS ANALYSIS** c46
M.-J. Munteanu, P. Piraino, and E. Kalnay *In its* Res. Rev., 1983 Jan. 1984 p 23-27 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

In order to study the relation between zone and the atmospheric circulation on a global scale the global correlation has been computed between TOMS total ozone measurements from NIMBUS-7 satellite and collocated geopotential heights analysis at all mandatory pressure levels between 1000-50 mb. The heights are obtained from the 4 deg x 5 deg GLAS analysis that uses both conventional (rawinsonde) and the operational TIROS-N satellite soundings but no ozone data. Zonal averages have been substracted to eliminate the correlation due merely to latitudinal dependence, and emphasize the correlation associated with synoptic features. Tables are presented with correlation coefficients for the four synoptic times covering the Pacific Ocean, Asia, Europe and the Atlantic Ocean, and United States regions. These coverages are approximate since NIMBUS-7 does not observe exactly the same region each day. B.W.

**N84-22057*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**COMPARISON OF AMSU TEMPERATURE SOUNDINGS WITH THOSE PRODUCED BY HIRS AND AMTS** c46
D. Reuter and J. Susskind *In its* Res. Rev., 1983 Jan. 1984 p 28-32 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The new generation of satellite borne radiometers to be launched in the late 1980's or early 1990's are currently planned to have as their main temperature sounding unit the AMSU (Advanced Microwave Sounding Unit). This device consists of two units, one of which contains 11 high spectral and spatial resolution channels which are to be used to produce vertical atmospheric temperature soundings. Other channels are to be used to determine atmospheric liquid water and water vapor amounts, as rain detectors, and for surface emissivity determination. This report, however, shall deal only with the accuracy of temperature retrievals. Toward this end studies have been carried out in which atmospheric temperature profiles were retrieved from simulated radiances for the AMSU channels. As a comparison, atmospheric temperature profiles were retrieved from simulated radiances for the currently operational HIRS infrared sounder as well as the proposed advanced infrared sounder AMTS. All simulations were based on a set of 400 mid-latitude radiosondes. Author

**N84-22058*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**WATER VAPOR PROFILE RETRIEVAL SIMULATION STUDIES FOR THE HIRS/MSU AND AMTS/MSU SOUNDERS** c46
D. Reuter and J. Susskind *In its* Res. Rev., 1983 Jan. 1984 p 33-40 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

A combined physical statistical method for the retrieval of atmospheric water vapor column densities has been developed at the Goddard Laboratory for Atmospheric Sciences. In this method differences between observed and calculated clear column brightness temperatures are used in a regression formalism to obtain estimates of integrated column densities in given atmospheric layers. The physics of the radiative transfer problem is contained in the calculated clear column brightness temperatures and in accounting for the effects of clouds on the observed radiances. The regression matrix is equivalent to a set of empirical sensitivity factors. Author

**N84-22059*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**RESULTS OF THE JOINT NASA/NOAA AMTS/HIRS2 SOUNDING SIMULATION TEST** c46
J. Susskind and D. Reuter *In its* Res. Rev., 1983 Jan. 1984 p 41-44 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

The relative accuracies of atmospheric temperature profiles retrieved from HIRS2, the current operational infra-red temperature sounder, and AMTS, a proposed advanced high-spectral resolution infra-red sounder were compared. The sounding simulation test compared retrievals generated by GLAS, using their physical retrieval algorithm, and NESDIS, using their operational statistical regression algorithm, for both instruments under clear and cloudy conditions. Test results for both conditions are summarized in tables showing RMS temperature errors for 18 tropospheric layers, 4 stratospheric layers, and surface skin temperature. The improvement of the AMTS instrument over HIRS2, particularly for cloudy conditions is demonstrated. The GLAS retrievals are more accurate than the operational NESDIS retrieval, especially with increasing cloud cover. A.R.H.

**N84-22060*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**IMPROVED HIRS2/MSU SOUNDINGS USING TROPOPAUSE INFORMATION** c46
J. Susskind, M.-J. Munteanu, and P. Piraino *In its* Res. Rev., 1983 Jan. 1984 p 45-48 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

In the GLAS physical retrieval scheme, all temperature profiles are expressed as an expansion about a global mean using empirical orthogonal functions derived from a sample of radiosondes. Total ozone burden, a parameter highly correlated with tropopause height, should be useful in improving sounding accuracy. The ability to estimate tropopause information from layer mean temperatures suggests incorporating the layer mean temperatures estimated from the sounding itself to give estimates of tropopause pressure and temperature. While information completely independent of sounding and first guess data is preferable, additional information is in fact added to the system by the statistical relationships between tropopause temperature and pressure and layer mean temperature profiles. This should not be confused with use of statistical relationships between temperature profiles and satellite observations, which form the basis of a statistical retrieval system but is in no way used in the physical retrieval scheme. A.R.H.

**N84-22061*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**COMPARISON OF GLAS RETRIEVED CLOUD FIELDS WITH MODEL GENERATED RAINFALL FIELDS**
J. Susskind and E. Kalnay *In its* Res. Rev., 1983 Jan. 1984 p 49-52 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Monthly mean fractional cloud cover for January and February 1979, retrieved from SOP 1 of FGGE, are compared with the total precipitation field derived diagonally from the GLAS analysis/forecast system for the same time period. The breakdown of cloudiness into day (3 AM) and night (3 PM) is consistent with maps of outgoing long wave and short wave radiation inferred from AVHHR data. Of the many regions of coincidence, there is a particularly striking phenomenon: west of the coast of Peru, at about 20 deg S, there is a distinct small scale maximum in precipitation which coincides precisely with a maximum in the cloudiness field. This maximum in cloudiness and precipitation does not appear in the NOAA/NESS fields of albedo and outgoing long wave radiation which are normally sensitive to cloud fields. These low level clouds with warm tops are a mainly nocturnal phenomenon. A.R.H.

**N84-22062*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**HIGH RESOLUTION GLAS ON THE MCIDAS**
J. Susskind, R. Atlas, and A. Pursch *In its* Res. Rev., 1983 Jan. 1984 p 53-59 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The GLAS physical inversion method for analysis of HIRS2/MSU data was implemented on the McIDAS. The method of analysis is identical to that used in processing global retrievals for six months of 1979, with the exception that the McIDAS retrievals are done on a higher spatial resolution, with one sounding attempted in every 4 x 4 array of HIRS2 spots, corresponding to roughly 80 x 80 km at nadir. This 4 x 4 array is further subdivided in 4 2 x 2 arrays with the sounding being performed utilizing all the spots in the single warmest 2 x 2 quadrant as sensed by the 11 micrometer window channel. Whether accurate retrievals can be performed on the high resolution grid without editing was determined. Different retrievals for a synoptic situation was compared and the guess dependence of the high resolution GLAS retrievals were examined. The orbit crossing the central United States at 1/21/79 09257 was studied. Radiosondes at 1200Z were used for comparison. A.R.H.

**N84-22063*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A NEW ALGORITHM FOR TUNING OF COMPUTED RADIANCES FOR HIRS2/MSU c46**
J. Susskind, P. Piraino, and D. Reuter *In its* Res. Rev., 1983 Jan. 1984 p 60-64 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

Small biases of the order of 1 C exist in brightness temperatures computed for a number of atmospheric sounding channels using radiosonde reports of atmospheric temperature humidity profile compared to those of collocated HIRS2/MSU observations on TIROS N. These biases are attributed to errors in the computed atmospheric transmittances functions. Channel dependent empirical tuning coefficients were found such that the biases in the channel brightness temperatures are removed if the transmittances used to calculate these brightness temperatures are modified. Possible shortcomings of this method are that some of the bias errors may be due to instrumental calibration problems and that the part that is computational may not be of the form assumed in the equation used. Form of tuning was implemented in the calculation which has the potential of distinguishing between calibration and calculation errors and is also computationally faster and more easily vectorizable. A.R.H.

**N84-22064*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE PREDICTION OF TROPOPAUSE HEIGHT FROM CLUSTERS OF BRIGHTNESS TEMPERATURES AND ITS APPLICATION IN THE STRATIFIED REGRESSION TEMPERATURE RETRIEVALS USING MICROWAVE AND INFRARED SATELLITE MEASUREMENTS c46**
M.-J. Munteanu, P. Piraino, and O. Jakubowicz *In its* Res. Rev., 1983 Jan. 1984 p 65-67 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A total of 1575 radiosondes and the corresponding simulated brightness temperatures were used in an effort to derive a temperature retrieval based on the clusters of brightness temperatures. The 8 simulated channels, namely, 3 MSU and 5 IR of the TIROS-N satellite are used by the GLAS temperature retrieval method. The 3 MSU and 5 IR brightness temperatures were clustered into 17 cluster groups and a regression for the prediction of the tropopause height in mb was generated. The overall r.m.s. for the tropopause prediction is excellent, namely, around 16 mb for the summer and 23 mb for the winter. The correct cluster of brightness temperatures can be identified 98% of the time by the method of discriminatory classification if it is approximately a normal distribution or, in general, by the method of the nearest neighbor. A.R.H.

**N84-22065*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**APPLICATIONS OF CLUSTER ANALYSIS TO SATELLITE SOUNDINGS c46**
M.-J. Munteanu, O. Jakubowicz, E. Kalnay, and P. Piraino *In its* Res. Rev., 1983 Jan. 1984 p 68-78 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

The advantages of the use of cluster analysis in the improvement of satellite temperature retrievals were evaluated since the use of natural clusters, which are associated with atmospheric temperature soundings characteristic of different types of air masses, has the potential for improving stratified regression schemes in comparison with currently used methods which stratify soundings based on latitude, season, and land/ocean. The method of discriminatory analysis was used. The correct cluster of temperature profiles from satellite measurements was located in 85% of the cases. Considerable improvement was observed at all mandatory levels using regression retrievals derived in the clusters of temperature (weighted and nonweighted) in comparison with the control experiment and with the regression retrievals derived in the clusters of brightness temperatures of 3 MSU and 5 IR channels. A.R.H.

**N84-22066*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EFFECT OF HIGH LATITUDE FILTERING ON NWP SKILL c46**
E. Kalnay, L. L. Takacs, and R. N. Hoffman *In its* Res. Rev., 1983 Jan. 1984 p 79-86 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

The high latitude filtering techniques commonly employed in global grid point models to eliminate the high frequency waves associated with the convergence of meridians, can introduce serious distortions which ultimately affect the solution at all latitudes. Experiments completed so far with the 4 deg x 5 deg, 9-level GLAS Fourth Order Model indicate that the high latitude filter currently in operation affects only minimally its forecasting skill. In one case, however, the use of pressure gradient filter significantly improved the forecast. Three day forecasts with the pressure gradient and operational filters are compared as are 5-day forecasts with no filter. A.R.H.

**N84-22067*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE EFFECT OF COMPACT IMPLICIT DIFFERENCING IN A BAROCLINIC PRIMITIVE EQUATIONS MODEL**
J. M. Augenbaum, S. E. Cohn (New York Univ.), and D. Marchesin (Pontificia Univ. Catolica do Rio de Janeiro) *In its* Res. Rev.,

1983 Jan. 1984 p 87-89 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

In an effort to improve forecast accuracy, the horizontal accuracy of gridpoint forecast models at a number of numerical weather prediction (NWP) centers was increased from second order to fourth order. The current GLAS model uses second-order explicit finite-difference formulas in the vertical and fourth-order explicit finite-difference formulas in the horizontal. Experiments are described which indicate the increased forecast accuracy gained by use of compact fourth-order finite differences in a simple baroclinic model. Tables show an increase in forecast accuracy by a factor of 100-150 by use of fourth-order instead of second-order vertical discretization. A.R.H.

**N84-22068*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A LAGRANGIAN METHOD FOR A TWO LAYER SHALLOW WATER MODEL** **c43**
J. M. Augenbaum *In its* Res. Rev., 1983 Jan. 1984 p 90-94 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 08H

One of the biggest drawbacks of Eulerian methods is the presence of the nonlinear convective terms which leads to inaccurate representations of advection and fronts. An alternative and conceptually simpler approach is the Lagrangian approach in which the fluid particles themselves are tracked and equations are derived based on local spatial interaction. In this formulation the nonlinear convective terms do not appear. The main drawback with the Lagrangian formulation, however, is that the local spatial interactions are time dependent. That is, at each time level, one must know the current neighbors of a given particle to accurately compute the forces acting on the particle. The Voroni Mesh which is continuously deforming and always linking nearest neighbors is needed. The effectiveness of a simple Lagrangian method for simulating the onset of a Kelvin-Helmholtz instability in a 2 layer fluid is demonstrated. A.R.H.

**N84-22069*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MULTIVARIATE OPTIMUM INTERPOLATION OF SURFACE PRESSURE AND WINDS OVER OCEANS**
S. C. Bloom *In its* Res. Rev., 1983 Jan. 1984 p 95-100 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The observations of surface pressure are quite sparse over oceanic areas. An effort to improve the analysis of surface pressure over oceans through the development of a multivariate surface analysis scheme which makes use of surface pressure and wind data is discussed. Although the present research used ship winds, future versions of this analysis scheme could utilize winds from additional sources, such as satellite scatterometer data. R.J.F.

**N84-22070*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DESIGN OF A LINEAR PROJECTOR FOR USE WITH THE NORMAL MODES OF THE GLAS 4TH ORDER GCM**
S. C. Bloom *In its* Res. Rev., 1983 Jan. 1984 p 101-105 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The design of a linear projector for use with the normal modes of a model of atmospheric circulation is discussed. A central element in any normal mode initialization scheme is the process by which a set of data fields - winds, temperatures or geopotentials, and surface pressures - are expressed ('projected') in terms of the coefficients of a model's normal modes. This process is completely analogous to the Fourier decomposition of a single field (indeed a FFT applied in the zonal direction is a part of the process). Complete separability in all three spatial dimensions is assumed. The basis functions for the modal expansion are given. An important feature of the normal modes is their coupling of the structures of different fields, thus a coefficient in a normal mode expansion would contain both mass and momentum information. R.J.F.

**N84-22071*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**COMPUTATIONAL ASPECTS OF THE NONLINEAR NORMAL MODE INITIALIZATION OF THE GLAS 4TH ORDER GCM**
I. M. Navon, S. C. Bloom, and L. Takacs *In its* Res. Rev., 1983 Jan. 1984 p 106-112 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Using the normal modes of the GLAS 4th Order Model, a Machenhauer nonlinear normal mode initialization (NLNMI) was carried out for the external vertical mode using the GLAS 4th Order shallow water equations model for an equivalent depth corresponding to that associated with the external vertical mode. A simple procedure was devised which was directed at identifying computational modes by following the rate of increase of BAL sub M, the partial (with respect to the zonal wavenumber m) sum of squares of the time change of the normal mode coefficients (for fixed vertical mode index) varying over the latitude index L of symmetric or antisymmetric gravity waves. A working algorithm is presented which speeds up the convergence of the iterative Machenhauer NLNMI. A 24 h integration using the NLNMI state was carried out using both Matsuno and leap-frog time-integration schemes; these runs were then compared to a 24 h integration starting from a non-initialized state. The maximal impact of the nonlinear normal mode initialization was found to occur 6-10 hours after the initial time. Author

**N84-22072*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A USER FRIENDLY OPERATING SYSTEM FOR THE GLAS 4TH ORDER FORECAST-ANALYSIS SYSTEM**
J. Pfaendtner *In its* Res. Rev., 1983 Jan. 1984 p 113-118 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The GLAS 4th Order Forecast-Analysis System is described in terms of its operating system requirements. A description of the operating system structure and components is given. R.J.F.

**N84-22073*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EMPIRICALLY DERIVED SECOND ORDER SCHEMES FOR THE ADVECTION EQUATIONS WITH MINIMUM DISSIPATION AND DISPERSION ERRORS** **c64**
L. L. Takacs *In its* Res. Rev., 1983 Jan. 1984 p 119-130 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 12A

Two second-order advection schemes of the Lax-Wendroff type are empirically derived which have accuracy and phase characteristics similar to that of a third-order scheme. The new schemes are compared with other currently used methods, and are shown to have superior behavior in simulating the advection of localized disturbances. The schemes are derived for constant flow and generalized to two-dimensional non-uniform flow. Author

**N84-22074*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ON THE EFFECT OF USING THE SHAPIRO FILTER TO SMOOTH WINDS ON A SPHERE** **c64**
L. L. Takacs and R. C. Balgovind *In its* Res. Rev., 1983 Jan. 1984 p 131-140 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 12A

Spatial differencing schemes which are not enstrophy conserving nor implicitly damping require global filtering of short waves to eliminate the build-up of energy in the shortest wavelengths due to aliasing. Takacs and Balgovind (1983) have shown that filtering on a sphere with a latitude dependent damping function will cause spurious vorticity and divergence source terms to occur if care is not taken to ensure the irrotationality of the gradients of the stream function and velocity potential. Using a shallow water

model with fourth-order energy-conserving spatial differencing, it is found that using a 16th-order Shapiro (1979) filter on the winds and heights to control nonlinear instability also creates spurious source terms when the winds are filtered in the meridional direction. Author

**N84-22075*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**LAGGED AVERAGE FORECASTING, SOME OPERATIONAL CONSIDERATIONS**
R. N. Hoffman and E. Kalnay *In its* Res. Rev., 1983 Jan. 1984 p 141-148 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The Lagged Average Forecast (LAF) method differs from the Monte Carlo Forecast (MCF) method in the definition of the ensemble of initial states which are used to generate the ensemble of forecasts. The LAF initial states are the current analysis and the forecasts made from previous analyses verifying the current time. Thus the LAF ensemble is composed of forecasts which are made by a regular operational system of numerical weather prediction and the LAF method is therefore operationally attractive. The application of the authors' previous ideas and results to an operational model requires the resolution of what might be called the degrees of freedom problem, i.e., how to obtain a homogeneous sample large enough to calculate stable statistics. It is suggested that this problem may be solved by carefully modeling the required statistics in terms of a small set of parameters and then estimating only these few parameters from the data. It is noted that there may be considerable information in each initial ensemble relating to the predictability of each particular case, and that this information may be incorporated in the model of the statistics. R.J.F.

**N84-22076*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**APPLICATION OF AUGMENTED-LAGRANGIAN METHODS IN METEOROLOGY: COMPARISON OF DIFFERENT CONJUGATE-GRADIENT CODES FOR LARGE-SCALE MINIMIZATION** c64
I. M. Navon *In its* Res. Rev., 1983 Jan. 1984 p 150-156 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 12A

A Lagrange multiplier method using techniques developed by Bertsekas (1982) was applied to solving the problem of enforcing simultaneous conservation of the nonlinear integral invariants of the shallow water equations on a limited area domain. This application of nonlinear constrained optimization is of the large dimensional type and the conjugate gradient method was found to be the only computationally viable method for the unconstrained minimization. Several conjugate-gradient codes were tested and compared for increasing accuracy requirements. Robustness and computational efficiency were the principal criteria. R.J.F.

**N84-22077*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PREDICTABILITY EXPERIMENTS USING A LOW ORDER EMPIRICALLY CORRECTED DYNAMICAL MODEL**
S. Schubert *In its* Res. Rev., 1983 Jan. 1984 p 157-163 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

It is generally accepted that day to day weather variations possess a finite range of predictability estimated to be approximately two weeks (e.g., Lorenz, 1965). However, considerable observational evidence points to the existence of a number of low frequency flow regimes which are potentially predictable beyond this limit. These include blocking events and teleconnection patterns such as those described in Wallace and Gutzler (1981). The problem of the predictability of such modes is addressed by employing a highly simplified dynamical model projected onto the modes of interest. These modes are computed from an empirical orthogonal function (EOF) analysis of 10-day averaged anomalies (deviations from the mean seasonal cycle) of the 500 mb stream function for the winters of 1967-76. The first three EOF's are associated with an index cycle and some of the teleconnection patterns. The fourth and ninth are related to North Pacific and North Atlantic blocking, respectively. R.J.F.

**N84-22078*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**INVESTIGATION OF THE EQUATORIAL OROGRAPHIC-DYNAMIC MECHANISM APPLYING THE BOUNDED DERIVATIVE METHOD**
F. H. M. Semazzi *In its* Res. Rev., 1983 Jan. 1984 p 164-167 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A system of equations which describe the motion of a barotropic fluid in the presence of bottom topography are presented. The mathematical expression for orography is developed and the bounded derivative initialization method is applied to suppress gravitational oscillations. A stationary orographic trough is simulated. The geopotential and zonal motion have maximum deviation from the mean state at the top of the mountain. Regarding meridional speed, outflow occurs on the windward slope and inflow on the leeward slope. Divergence of order (10(-6)s(-1) is found on the windward slope while convergence of the same order of magnitude resides on the leeward slope. This outcome may have interesting implications regarding real climatology occurring over the equatorial regions of continental land masses. M.G.

**N84-22079*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**POSTPROCESSING FOR THE UCLA CLIMATE MODEL**
J. Abeles, E. Pittarelli, D. A. Randall, and M. J. Suarez *In its* Res. Rev., 1983 Jan. 1984 p 171-174 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Postprocessing programs written to analyze the results of a general circulation model are described. The model history data is interpolated to pressure surfaces, converted from 64-bit Cyber words to 32 bit IBM words, and transferred to tape for further analysis. The time average program reads the interpolation output tape and produces 15-day time averages. The model outputs a very detailed record for selected grid points. This data is sent to a tape in Cyber full words. The conversion program changes the format of the tape from 64 bit Cyber words to 32 bit IBM words, processing a month of data at a time. The grid-point history sorting program inputs the converted grid point history tape and sorts it by time. The end product is a tape with a time history of each field for every point. After the PBP data has been stored, it can be plotted. The plotting package is flexible, and allows the choice of fields and grid points. The one-dimensional fields are plotted as functions of time, and a daily summary is also produced. For the two-dimensional fields, time-height cross sections and daily summaries are produced. The model plotting package produces plots for all fields on the time average and pressure tapes. These plots include world maps, polar projections, zonal means, vectors, streamlines, and latitude-height plots. M.G.

**N84-22080*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE GROWTH, PROPAGATION AND DECAY OF GLOBAL SCALE ROSSBY WAVES DURING FGGE** c46
R. S. Lindzen, D. M. Straus, and B. Katz *In its* Res. Rev., 1983 Jan. 1984 p 175-179 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

A portrait of the evolution of global scale Rossby waves for the FGGE year is presented. Emphasis is placed on the temporal evolution of the amplitude and phase of Hough mode projections, rather than on characteristics of the time spectra of these waves. On the basis of previous work, it was felt that it would be adequate to consider the 500 mb level in isolation from the others, and that the Hough functions (which are vector functions of the horizontal wind components and the height field) were good approximations to the 'true' eigenfunctions. Thus, the first steps of the analysis consisted of projecting the 500 mb height and wind data (obtained from the ECMWF analyses) onto Hough

functions for each synoptic time. The seasonal cycle and time mean were removed separately for each season, and all remaining eastward propagating components removed on a seasonal basis; all remaining westward propagating components were retained. M.G.

**N84-22081*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**INTERANNUAL VARIABILITY OF INDIAN MONSOON RAINFALL**
D. A. Paolino and J. Shukla *In its* Res. Rev., 1983 Jan. 1984 p 180-184 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The interannual variability of the Indian summer monsoon and its relationships with other atmospheric fluctuations were studied in hopes of gaining some insight into the predicability of the rainfall. Rainfall data for 31 meteorological subdivisions over India were provided by the India Meteorological Department (IMD). Fifty-three years of seasonal mean anomaly sea-level pressure (SLP) fields were used to determine if any relationships could be detected between fluctuations in Northern Hemisphere surface pressure and Indian monsoon rainfall. Three month running mean sea-level pressure anomalies at Darwin (close to one of the centers of the Southern Oscillation) were compiled for months preceding and following extreme years for rainfall averaged over all of India. Anomalies are small before the monsoon, but are quite large in months following the summer season. However, there is a large decrease in Darwin pressure for months preceding a heavy monsoon, while a deficient monsoon is preceded by a sharp increase in Darwin pressure. If a time series is constructed of the tendency of Darwin SLP between the Northern Hemisphere winter (DJF) and spring (MAM) and a correlation coefficient is computed between it and 81 years of rainfall average over all of India, one gets a C. C. of -.46, which is higher than any other previously computed predictor of the monsoon rainfall. This relationship can also be used to make a qualitative forecast for rainfall over the whole of India by considering the sign of the tendency in extreme monsoon years. M.G.

**N84-22082*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE SIMULATION OF TRANSIENT STATISTICS OF THE SOUTHERN HEMISPHERIC CIRCULATION BY THE GLAS SEASONAL CYCLE MODEL: PRELIMINARY RESULTS**
D. M. Straus and J. Shukla *In its* Res. Rev., 1983 Jan. 1984 p 185-189 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The general circulation of the Southern Hemisphere is quite different from that of the Northern Hemisphere in many important ways. These include the barotropic nature of the stationary waves and the presence of a strong barotropic component to the mean zonal wind, the lack of a strong seasonal dependence of the transient eddies, and the dominant role played by eddies with periods less than 10 days compared to longer period fluctuations. Such differences attest to the importance of the altered nature of the orographic and thermal land-sea forcings in the Southern Hemisphere compared to the Northern Hemisphere. Some of the important features of the Southern Hemisphere circulation as simulated by the GLAS Seasonal Cycle Model (SCM) are presented. The geographical patterns of local variability and their seasonal shifts in the SCM are discussed and compared to observations. M.G.

**N84-22083*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**LOCALIZED BLOCKING ACCOUNTED FOR BY SLOW VARIATIONS OF THE ZONAL DRIVING**
K. C. Mo *In its* Res. Rev., 1983 Jan. 1984 p 190-192 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The incorporation of observed zonal topography in a barotropic nonlinear channel model is discussed. The model is then extended to explain the regional features of blocking by employing a two scale method to allow small slow variations of the momentum (zonal) driving. M.G.

**N84-22084*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**TELECONNECTION PATTERNS IN THE SOUTHERN HEMISPHERE**
K. C. Mo and G. H. White *In its* Res. Rev., 1983 Jan. 1984 p 193-195 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Contemporaneous correlations between geopotential heights on a given pressure surface at widely separated points on Earth, commonly referred to as teleconnections, are calculated from monthly mean sea level pressure and 500 mb geopotential height analyses for the Southern Hemisphere for five-month winter and summer seasons. During summer (November-March), anomalies over the three continents occur out of phase with anomalies over the subtropical oceans and in a wavenumber 3 pattern over the Southern Ocean near 55 deg S. The subtropical part of the pattern appears largely associated with the interannual variation of the seasonal cycle and annual mean. In winter (May-September) 500 mb geopotential heights over Africa exhibit positive correlations with heights over South America and the central South Pacific near New Zealand and negative correlations with height over the Southern Ocean. A striking wavenumber three pattern is apparent which shows the correlation of 500 mb geopotential height anomalies with 500 mb anomalies at 50 deg S, 95 deg E during winter. The strong positive correlations between 50 deg S, 95 E and 58 deg S, 150 deg W and 38 deg S, 15 deg W contrast with negative correlations over Antarctica and in low latitudes. Time variations in a similar pattern in sea level pressure are in phase with variations in the 500 mb pattern, suggesting an equivalent barotropic structure. M.G.

**N84-22085*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**OCEAN FLUXES SIMULATED BY THE GLAS GCM**
Y. C. Sud and J. Shukla *In its* Res. Rev., 1983 Jan. 1984 p 196-204 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A two year run with the GLAS climate model with prescribed but seasonally varying boundary conditions provided mean monthly fluxes of sensible heat, latent heat, and radiative energy. These fluxes were analyzed to examine the energy exchange processes between the atmosphere and the ice-free ocean. A mean annual plot of monthly zonal fuxes of sensible heat, latent heat, and net radiation was produced. From these, northward transport of heat flux that would follow if the GCM simulated fluxes were consistent with oceanic circulation were produced. These results are compared with observations. M.G.

**N84-22086*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ON THE ROLE OF THE TRANSIENT EDDIES IN MAINTAINING THE SEASONAL MEAN CIRCULATION**
G. H. White and B. J. Hoskins *In its* Res. Rev., 1983 Jan. 1984 p 205-208 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The role of transient eddies in maintaining the observed local seasonal mean atmospheric circulation was investigated by examining the time-averaged momentum balances and omega equation, using seasonal statistics calculated from daily operational analyses by the European Centre for Medium Range Weather Forecasts. While both the Northern and Southern Hemispheres and several seasons were studied, emphasis was placed upon the Northern Hemisphere during December 1981-February 1982. The results showed that transient eddies played a secondary role in the seasonal mean zonal momentum budget and in the forcing of seasonal mean vertical and a geostrophic motion. M.G.

**N84-22087*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**TWO CONTRASTING NORTHERN HEMISPHERE WINTERS:**

**1980 - 1981 AND 1981 - 1982**
G. H. White *In its* Res. Rev., 1983 Jan. 1984 p 209-214 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Seasonal statistics calculated from daily operational analyses by the European Centre for Medium Range Weather Forecasts for December 1980 - February 1981 (season 1) and December 1981 - February 1982 (season 2) were used to contrast the two seasonal mean circulation patterns present in the Northern Hemisphere and to investigate possible causes for the differences. The vertically averaged seasonal mean zonal wind and E-vector, a measure of the anisotropy of the transient eddies over the Pacific is shown for season 1 and season 2. The pattern in season 2, but not season 1, resembles that found in a modeling study of barotropic instability. One possible explanation for the differences between season 1 and 2 is a weak change in tropical heating associated with the southern oscillation, the effect of which in midlatitude was amplified by the occurrence of barotropic instability over the Pacific in season 2, but not season 1. E.A.K.

**N84-22088*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PROSPECTS FOR IMPROVEMENT OF ZONAL MEAN TEMPERATURES IN THE UCLA GENERAL CIRCULATION MODEL**
T. Corsetti, M. J. Suarez, and D. A. Randall *In its* Res. Rev., 1983 Jan. 1984 p 215-218 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The scheme proposed by Katayama for the calculation of long wave radiative cooling rates is described. A number of offline calculations to test the new code were examined. It is suggested that the new scheme should alleviate the model's cold pole problem. Author

**N84-22089*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**FORCED STATIONARY SOLUTIONS IN A BAROTROPIC CHANNEL: MULTIPLE EQUILIBRIA AND THEORY OF NONLINEAR RESONANCE**
S. Rambaldi, K. C. Mo, and J. Shukla *In its* Res. Rev., 1983 Jan. 1984 p 219-221 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A barotropic flow over sinusoidal topography in a beta channel in the presence of forcing and dissipation was studied. The work is divided into two parts: (1) computation of the stationary solutions of the model, by Newton's method together with a finite difference approximation, and comparison of solutions with the solutions of the linear theory; (2) development of a nonlinear theory that reproduce the numerical solutions. E.A.K.

**N84-22090*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**STRATOCUMULUS SIMULATIONS WITH A GENERAL CIRCULATION MODEL**
D. A. Randall, J. Abeles, and M. J. Suarez *In its* Res. Rev., 1983 Jan. 1984 p 222-226 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Stratus and stratocumulus cloud sheets which are among the most common cloud types over the world are discussed. They are characteristic of the undisturbed subtropical marine boundary layer over the eastern oceans, where cool water and large scale sinking motion suppress penetrative cumulus convection. They also occur over the Arctic Ocean, particularly in summer, and behind cold outbreaks over the western oceans in winter. Observational studies were conducted and further observations are planned. E.A.K.

**N84-22091*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**CLIMATE SENSITIVITY WITH A SEASONAL CYCLE ENERGY BALANCE MODEL**
M. J. Suarez *In its* Res. Rev., 1983 Jan. 1984 p 227-230 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The sensitivity of climate which may have a local maximum as the ice cap passes through a midlatitude region where the atmosphere's transport efficiency varies strongly with latitude is examined. This behavior, found in a two level primitive equations climate model forced with annual mean insolation, was reproduced in an energy balance model (EBM) by making the diffusion coefficient a function of latitude. The two level seasonally varying EBM was applied and the global mean surface temperature vs. solar constant for this model are shown and two regions of enhanced sensitivity appear. The snowcover distributions around the year for three cases are shown. E.A.K.

**N84-22092*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DESIGN FOR AND EFFICIENT DYNAMIC CLIMATE MODEL WITH REALISTIC GEOGRAPHY**
M. J. Suarez and J. Abeles *In its* Res. Rev., 1983 Jan. 1984 p 231-232 ref (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The long term climate sensitivity which include realistic atmospheric dynamics are severely restricted by the expense of integrating atmospheric general circulation models are discussed. Taking as an example models used at GSFC for this dynamic model is an alternative which is of much lower horizontal or vertical resolution. The model of Heid and Suarez uses only two levels in the vertical and, although it has conventional grid resolution in the meridional direction, horizontal resolution is reduced by keeping only a few degrees of freedom in the zonal wavenumber spectrum. Without zonally asymmetric forcing this model simulates a day in roughly 1/2 second on a CRAY. The model under discussion is a fully finite differenced, zonally asymmetric version of the Heid-Suarez model. It is anticipated that speeds can be obtained a few seconds a day roughly 50 times faster than moderate resolution, multilayer GCM's. E.A.K.

**N84-22093*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DESIGN OF COUPLED OCEAN-ATMOSPHERE EXPERIMENTS**
M. J. Suarez and P. Schopf *In its* Res. Rev., 1983 Jan. 1984 p 233-238 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A series of numerical experiments which couple an atmospheric general circulation model to an ocean model in an idealized basin are discussed. The role of ocean atmosphere interactions in the development of anomalous sea surface temperatures during an El Nino event is outlined. E.A.K.

**N84-22094*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**LONG-TERM DYNAMICAL STABILITY AND TRANSITION IN A SPECTRAL MODEL**
R. L. Wobus *In its* Res. Rev., 1983 Jan. 1984 p 239-242 ref (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The relationship between blocking and multiple equilibria was investigated in a two layer model of the Northern Hemisphere January heating and boundary conditions are imposed. The truncation varies over global wavenumbers 4-8 and the coefficients of horizontal diffusion of heat and potential vorticity are varied about realistic values. It is shown that while severely truncated models can exhibit multiple quasi equilibria under realistic domain, forcing, and boundary conditions, higher resolution is required to allow realistic transitions to be mediated by strong baroclinic wave activity. It is indicated that for extended range forecasting blocking transitions are not likely to be forecast well unless the associated synoptic events can be forecasted statistically. E.A.K.

**N84-22095*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DIAGNOSIS OF THE GLAS CLIMATE MODEL'S STATIONARY**

**PLANETARY WAVES USING A LINEARIZED STEADY STATE MODEL**
C. Youngblut *In its* Res. Rev., 1983 Jan. 1984 p 243-244 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

Orography and geographically fixed heat sources which force a zonally asymmetric motion field are examined. An extensive space-time spectral analysis of the GLAS climate model (D130) response and observations are compared. An updated version of the model (D150) showed a remarkable improvement in the simulation of the standing waves. The main differences in the model code are an improved boundary layer flux computation and a more realistic specification of the global boundary conditions.
E.A.K.

**N84-22096*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**HORIZONTAL ENERGY PROPAGATION IN A BAROCLINIC ATMOSPHERE WITH MERIDIONAL AND ZONAL STRUCTURE**
C. Youngblut *In its* Res. Rev., 1983 Jan. 1984 p 245-246 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A baroclinic model was developed. The model is linear, steady state, baroclinic (2 level) and based on the primitive equations. The unique features of the model are: (1) The basic state u and T fields are functions of wavelength, theta, and rho, (2) A mean meridional circulation v, w, which may be a function of wavelength, theta, and rho, and p may be included, (3) Dissipation may be a function of theta, wavelength, rho, p (e.g., differ over land and sea). Because the basic state is a function of longitude, the equations are not separable in wavelength and the usual semi-spectral solution procedure is not applicable. The model solutions can be found in a straight forward (brute force) way by discretizing the model equations directly on a wavelength, theta, rho, p grid. There are six dependent (perturbation) variables: u, v, and geopotential at levels 1 and 2. The thermal forcing is prescribed at the intermediate vertical level. The linearized equations may be written. M.A.C.

**N84-22097*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DEVELOPMENT AND PRELIMINARY TESTS OF A NEW LONG-WAVE RADIATION PARAMETERIZATION c46**
Harshvardhan, T. Corsetti, D. A. Randall, and M. J. Suarez *In its* Res. Rev., 1983 Jan. 1984 p 251-253 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

An efficient broad band longwave radiation code for CO2 and H2O and for O3 was developed. There are two bands each in the CO2 and H2O absorption regions, one for the band center and one for the band wings. One band covers O3 absorption and the overlapping H2O continuum. Overlap is also considered in the CO2 region, and there is H2O continuum absorption where applicable. Clouds are considered nonreflecting in the longwave. Therefore partial cover or partial transmission can be allowed for, by considering a cloud fraction at each atmospheric level. A special subroutine was written to allow for maximum or random overlap of clouds that may be used in the future. All algorithms were written with vectorization in mind with identical operations made for all horizontal grid points in a latitude circle. Where possible, operations are carried out covering the vertical grid points as well, yielding long vectors for efficient computations. M.A.C.

**N84-22098*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SIMULATIONS OF THE STRATOCUMULUS-TOPPED BOUNDARY LAYER WITH A THIRD-ORDER CLOSURE MODEL c46**
C.-H. Moeng and D. A. Randall *In its* Res. Rev., 1983 Jan. 1984 p 254-256 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

A third order closure model is proposed by Andre et al. (1982), in which the time rate of change terms, the relaxation and rapid effects for the pressure related terms, and the clipping approximation are included along with the quasi-normal closure, to study turbulence in a cloudy layer which is cooled radiatively from above. A spurious oscillation which is strongest near the inversion occurs. An analysis of the problem shows that the oscillation arises from the mean gradient and buoyancy terms of the triple moment equations; these terms are largest near the cloud top. The oscillation is physical, rather than computational. In nature the oscillation is effectively damped, by a mechanism which apparently is not included in our model. In the stably stratified layer just above the mixed layer top, turbulence can excite gravity waves, whose energy is radiated away. Because the closure assumption for the pressure terms does not take into account the transport of wave energy, the model generates spurious oscillations. Damping of the oscillations is possible by introducing diffusion terms into the triple moment equations. With a large enough choice for the diffusion coefficient, the oscillation is effectively eliminated. The results are quite sensitive to the ad hoc eddy coefficient.
M.A.C.

**N84-22099*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PROBLEMS WITH THE PROCESS PARTITIONING THEORY OF STRATOCUMULUS ENTRAINMENT c46**
David A. Randall *In its* Res. Rev., 1983 Jan. 1984 p 257-260 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

Three different approaches to partitioning were proposed. Ball (1960), Lilly (1968), and Deardorff et al. (1969, 1974) considered the sign of the net buoyancy flux at each level. If the net flux is positive, it is counted as TKE producing; otherwise, it is counted as TKE consuming. This approach can be called Eulerian partitioning. The second approach can be called process partitioning. It is assumed that the various processes acting in concert each produce and consume the same energy as if they acted independently (Manins and Turner, 1978). The total rates of TKE production and consumption are obtained by summing the effects of all the forcing processes. The third approach is Lagrangian partitioning. Each air parcel is considered as either producing or consuming TKE, according to the sign of the product of its density and vertical velocity anomalies. Stage and Businger (1981a,b) have applied process partitioning to the cloud topped mixed layer. One of the most important processes influencing entrainment into such a layer is cloud top radiative cooling. The production and consumption due to entrainment and radiative cooling are thus closely related. Model results are sensitive to the choice of formulation. M.A.C.

**N84-22100*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**CAN CLOUD-TOP ENTRAINMENT PROMOTE CLOUD GROWTH?**
David A. Randall *In its* Res. Rev., 1983 Jan. 1984 p 261-265 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The primary significance of Cloud Deepening through Entrainment (CDE) is that it can prevent the cloud top entrainment instability from destroying a cloud deck. Without suppressing the instability, CDE transforms it from a cloud destroyer to a cloud builder. The analysis does not depend on an entrainment hypothesis. Moreover, it is not restricted to PBL stratocumulus sheets. Stratiform clouds in the free atmosphere can be subject to CDE we need only reinterpret Ps as the pressure at the base of an elevated turbulent mixed layer. Modest departures from well mixedness will alter the results quantitatively but not qualitatively. Processes other than entrainment, such as surface evaporation, radiative cooling, and advection will often work with CDE to build a cloud layer; but of course they can also oppose CDE by reducing the relative humidity. If we make the weak assumption that the deepening of a cloud layer favors an increase in the cloud top entrainment rate (without specifying any particular functional relationship) we are led to speculate that CDE can cause runaway cloud growth, even in the absence of cloud top entrainment instability. through CDE entrainment leads to a deeper cloud, which leads to stronger entrainment. M.A.C.

**N84-22101*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ON THE BIMODALITY OF TEMPERATURE AND MOISTURE NEAR STRATOCUMULUS CLOUD TOPS**
David A. Randall *In its* Res. Rev., 1983 Jan. 1984 p 266-269 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The observed distributions of the thermodynamic variables near stratocumulus top are highly bimodal (Mahrt and Paumier, 1982). This suggests a model based on the assumption of a joint bimodal distribution of parcels, obtained as the weighted sum of two binormal distributions. The properties of joint normal distribution, G, show that there will almost always have two distinct populations. M.A.C.

**N84-22102*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**AN ENSEMBLE FORMULATION OF PBL FLUXES IN A GCM**
Y. C. Sud and W. E. Smith *In its* Res. Rev., 1983 Jan. 1984 p 270-274 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

An ensemble approach is applied to Planetary Boundary Layer (PBL) calculations with the bulk Richardson number identified as the key parameter. An ensemble averaging calculation was carried out to rederive the bulk friction and heat transport coefficients for the mean condition. Two simulations are carried out and compared. Significant differences in PBL fluxes low level cloudiness, land surface roughness heights, and surface evaporation are noted between the modified and unmodified simulations. Modifications to the model were: (1) the relationship between actual and potential Effective Temperature (ET) to accord with Sud and Fennessy (1982); (2) maximum permissible instantaneous ET at any time is 1.5 mm per hr; (3) moisture distribution in low level cumulus convection to be consistent with no precipitation; (4) appearance of supersaturation clouds to be consistent with supersaturation condition at that level; (5) invoking a simple function for stomatal diffusion effect in the ET calculation. M.A.C.

**N84-22103*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A NOTE ON THE TEMPORAL BEHAVIOR OF BUCKET HYDROLOGIES** **c43**
M. J. Suarez *In its* Res. Rev., 1983 Jan. 1984 p 275-284 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 08H

The use of a 'canopy' bucket to more accurately represent evapotranspiration over land surfaces is explained. The temporal behavior of the traditional bucket model is compared with one that mimics the effects of interception loss. Results are presented in terms of the spectral response of the parameterization to a hypothetical white noise forcing. M.A.C.

**N84-22104*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**TIME DEPENDENT LAND AND VEGETATION CANOPY TEMPERATURES** **c43**
Y. C. Sud *In its* Res. Rev., 1983 Jan. 1984 p 285-291 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 02F

A simple interactive biosphere is presented based on an electrical analog of turbulent transport processes that produce heat and moisture fluxes between land and the atmosphere. A network of resistances that effect temperature or vapor pressure fluxes are identified and entered into the quasi steady state equations. A set of solutions that depict a realistic diurnal cycle is included. M.A.C.

**N84-22105*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A NEW PARAMETERIZATION OF 15 MICRON RADIATIVE TRANSFER FOR A GCM** **c46**
R. L. Wobus, J. Susskind, and M.-L. C. Wu *In its* Res. Rev., 1983 Jan. 1984 p 292-295 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

In order to make the Wu-Kaplan longwave radiative transfer parameterization (Krishnamurthy, 1982) presently used in the 9 layer GLAS GCM more suitable for use at higher horizontal and vertical resolutions, the fixed CO2 transmittance tables and climatological O3 transmittances are replaced with appropriate models. Results of off line tests of simple models of CO2 transmittance as a function of atmospheric temperature profile and surface pressure, based on the technique used by Susskind et al. (1983) in the GLAS physical retrieval scheme are given. The models are evaluated in terms of transmittance error, flux divergence error, and equilibrium temperature error. The transmittances of CO2 averaged over each of the spectral bands 500-660 cm-1 and 660-800 cm-1 are modeled, following Susskind et al., 1983, as products of effective layer transmittances. R.J.F.

**N84-22106*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**GCM SENSITIVITY TO 1982 - 1983 EQUATORIAL PACIFIC SEA SURFACE TEMPERATURE ANOMALIES**
M. J. Fennessy, L. Marx, and J. Shukla *In its* Res. Rev., 1983 Jan. 1984 p 301-311 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The response of the GLAS climate model to the much larger 1982-83 sea surface temperatures (SST) anomalies is discussed. Two separate 75 day experiments (control and anomaly simulation pairs) were started from observed initial conditions on 16 Dec. 1982 and initial conditions on 16 Dec. 1979 taken from a 2 year model control run after one year of simulation, respectively. The January control and anomaly SST fields used in both experiments are given. Notable is the greatly extended region of very warm (approximately equal to 29 C) SST water in the anomaly simulation. The January SST anomaly field is representative of the other months of the experiments, all of which had a much larger region of very warm SST in the anomaly simulation than in the previously noted general circulation model studies. The model used is an improved version of the GLAS B-grid GCM used by Shukla and Wallace (1983). The most important physical change in the model is the inclusion of the surface flux parameterization of Deardorff (1972) as modified by Randall (1976). An important improvement in the model simulations is the removal of the climate drift towards unrealistically high temperatures in the tropics, which was moted by Shukla and Wallace (1983). R.J.F.

**N84-22107*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**IMPACT OF PRESCRIBED DIABATIC HEATING ON SHORT RANGE WEATHER FORECASTS** **c46**
L. Marx and J. Shukla *In its* Res. Rev., 1983 Jan. 1984 p 312-322 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04A

Using the 9 layer general circulation model developed at the Goddard Laboratory for Atmospheric Sciences (GLAS), several 4 to 5 day integrations were made to assess the impact that latent heating processes (supersaturation and moist convective) have on the model forecasts. In an earlier study by Shukla (1981) it was hypothesized that because of strong interaction between dynamics and moist convection, small initial errors grow very fast and make short range forecasting difficult. The purpose of this study was to examine if prescribed heating rates can improve the forecasts for a few days. Author

**N84-22108*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE SENSITIVITY OF A GENERAL CIRCULATION MODEL TO SAHARAN DUST HEATING**
D. A. Randall, T. Carlson, and Y. Mintz *In its* Res. Rev., 1983 Jan. 1984 p 3323-328 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

During the Northern summer, sporadic outbreaks of wind borne

Saharan dust are carried out over the Atlantic by the tropical easterlies. Optical depths due to the dust can reach 3 near the African coast, and the dust cloud can be detected as far west as the Caribbean Sea (Carlson, 1979). In order to obtain insight into the possible effects of Saharan dust on the weather and climate of North Africa and the tropical Atlantic Ocean, simulation experiments have been performed with the Climate Model of the Goddard Laboratory for Atmospheric Sciences. The most recent version of the model is described by Randall (1982). The model produces realistic simulations of many aspects of the observed climate and its seasonal variation. B.W.

**N84-22109*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**INFLUENCE OF SURFACE ROUGHNESS OF A DESERT**

Y. C. Sud and W. E. Smith *In its* Res. Rev., 1983 Jan. 1984 p 329-334 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A numerical simulation study, using the current GLAS climate GCM, was carried out to examine the influence of low bulk aerodynamic drag parameter in the deserts. The results illustrate the importance of yet another feedback effect of a desert on itself, that is produced by the reduction in surface roughness height of land once the vegetation dies and desert forms. Apart from affecting the moisture convergence, low bulk transport coefficients of a desert lead to enhanced longwave cooling and sinking which together reduce precipitation by Charney's (1975) mechanism. Thus, this effect, together with albedo and soil moisture influence, perpetuate a desert condition through its geophysical feedback effect. The study further suggests that man made deserts is a viable hypothesis. M.G.

**N84-22110*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**ROLE OF SOIL MOISTURE IN MAINTAINING DROUGHTS**

y. C. Sud and W. E. Smith *In its* Res. Rev., 1983 Jan. 1984 p 335-340 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

The influence of soil moisture on the persistence of an ongoing drought was investigated. The case study of drought of the summer of 1980 was selected. The difference in the simulation of two identical twin runs: one with the climatological normal soil moisture and the other with anomalous soil moisture for drought conditions, were examined on the mean monthly circulation. It is found that a reduction in soil moisture did produce a corresponding reduction in precipitation. The pattern of the rainfall anomaly however, was not identical to the soil moisture (evapotranspiration) anomaly but had a good resemblance with observations. E.A.K.

**N84-22111*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**A DYNAMICAL BASIS FOR THE PARAMETERIZATION OF ORGANIZED DEEP CONVECTION IN LARGE-SCALE NUMERICAL MODELS**

M. W. Moncrieff *In* NASA. Goddard Space Flight Center Res. Rev., 1983 Jan. 1984 p 347-348 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

A hierarchy of steady, nonlinear, semianalytic models of different types of convection were produced. These provide a theoretical framework for determining cloud outflow fluxes of both dynamic and thermodynamic quantities, which can be used to formulate dynamical transports in parameterization schemes. This was achieved by exploiting certain Lagrangian conservation properties of steady flow, from which an equation for the vertical displacement of particles can be obtained and the outflow entropy, energy and momentum fluxes and the inflow/outflow mass fluxes can be determined from solution to the equation. These fluxes are determined in terms of grid scale parameters such as convective available potential energy (CAPE), cloud layer shear, and horizontal pressure gradients. Five main types of system models are identified, respectively representing archtypes of convection in zero shear, large shear, midlatitude squall lines, tropical squall lines and cellular convection. The downdraught is an important aspect in the first four of these and the cloud scale transport of momentum is very distinctive. E.A.K.

**N84-22112*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**SOME PROPERTIES OF TRANSIENT PHENOMENA IN THE EXTRA-TROPICAL REGION AND THEIR IMPORTANCE IN THE SEASONAL MEAN FLOW Abstract Only**

B. J. Hoskins *In* NASA. Goddard Space Flight Center Res. Rev., 1983 Jan. 1984 p 349 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

When studying data for one season, it is convenient to divide transient eddies into those of the synoptic time scale and those of lower frequency. Where the dividing line is placed is not crucial, but a 10-day period is used in a study of the 1979-1980 Northern Hemisphere winter. The synoptic time scale eddies exhibit maximum kinetic energy in stormtracks slightly downstream from and poleward of the Atlantic and Pacific jet maximum. An alternative approach is via the anisotropic part of the horizontal velocity correlation tensor, the axis of which gives the local orientation of the eddies and the magnitude a measure of the extension of the eddies. When the man velocity field is almost that of the plane waves, the horizontal group velocity relative to the mean field is also related to this tensor. The synoptic time scale eddies force the mean flow in the sense of reducing the baroclinic component in the upstream of the region of the stormtrack. The lower frequency eddies have a very different signature. A.R.H.

**N84-22113*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**LOW FREQUENCY VARIABILITY AND TROPICAL-EXTRATROPICAL INTERACTIONS Abstract Only**

Dennis L. Hartmann *In* NASA. Goddard Space Flight Center Res. Rev., 1983 Jan. 1984 p 350 (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 04B

In this investigation of relationships between mid-latitude 500 mb anomalies and tropical heating anomalies on the time scales of weeks to seasons are studied using outgoing IR to characterize the tropical convection heating. The data are first used to form 5-day means and the mean seasonal cycle and the interannual variability of seasonal means are then removed. The time scales considered are then between about 10 days and 90 days. By correlating the mid-latitude height anomalies with the tropical precipitation anomalies it can be shown that, on the time scales considered here, the predominant correlation patterns are those associated with Rossby waves propagating from mid-latitudes into the tropics and influencing the tropical convection. The mid-latitude Rossby waves can significantly influence convection to within 5 degrees of the equator. B.W.

**N84-22114#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**THE WATER BALANCE AND CLIMATE**

Luiz Carlos Baldicero Molion Feb. 1984 12 p refs Presented at the Climate Conf. for Latin Am. and the Caribbean, Paipa, Columbia, 28 Nov. - 3 Dec. 1983; sponsored by the World Meteorological Organization
(INPE-2997-PRE/449) Avail: NTIS HC A02/MF A01

The climatic influence of the hydrologic cycle is reviewed with emphasis on tropical regions. The latitudinal distribution of precipitation shows a maximum in the Intertropical Convergence Zone (ITCZ), relative minimal in the regions dominated by the subtropical anticyclones and secondary maximal in mid latitudes. On the other hand, evaporation presents maximal in the regions of the subtropical anticyclones. Global patterns indicate that the tropics rainfall is larger over continents than over oceans. The hydrologic cycle of a large continental area, the Amazonas Basin, is discussed in more detail. The long term average water balance of this basin, together with the hypothesis of climate stability, are used to demonstrate that the annual river discharge is equal to

the net advection of water vapor into the basin. The computed net advection was found to explain about 50% of the mean annual rainfall. The remaining 50% is provided by water evaporated locally. In this scenario, the controvertial interaction between the forest and the hydrologic cycle is highlighted. Author

**N84-22115*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**THE AMAZON AND CLIMATE**
Carlos Afonso Nobre Feb. 1984 10 p refs Presented at the WMO Climate Conf. for Latin Am. and the Caribbean, Paipa (Colombia), 28 Nov. - 3 Dec. 1983
(Contract NAS5-27297)
(NASA-CR-173408; NAS 1.26:173408; INPE-2999-PRE/451) Avail: NTIS HC A02/MF A01 CSCL 04B

The climatologies of cloudiness and precipitation for the Amazon, are reviewed and the physical causes of some of the observed features and those which are not well known are explained. The atmospheric circulation over the Amazon is discussed on the large scale tropical circulations forced by deep diabatic heating sources. Weather deforestation which leads to a reduction in evapotranspiration into the atmosphere, and a reduction in precipitation and its implicated for the gobal climate is discussed. It is indicated that a large scale clearing of tropical rainforests there would be a reduction in rainfall which would have global effects on climate and weather both in the tropical and extratropical regions. E.A.K.

**N84-22116*#** National Aeronautics and Space Administration, Washington, D. C.
**SATELLITE DATA RELAY AND PLATFORM LOCATING IN OCEANOGRAPHY. REPORT OF THE IN SITU OCEAN SCIENCE WORKING GROUP**
Robert Chase (Woods Hole Oceanographic Inst.), Chuck Cote (NASA Goddard Space Flight Center), Russ E. Davis (Scripps Inst. of Oceanography), John Dugan (Naval Research Lab.), Don D. Frame (NAVAIRSCOM), David Halpern (NOAA/Pacific Marine Environmental Lab.), Ed Kerut, Robert Kirk (NASA Goddard Space Flight Center), Lawrence McGoldrick (NASA, Washington, D.C.), and James McWilliams (National Center for Atmospheric Research) Nov. 1983 56 p refs
(Contract NAS5-26714)
(NASA-TM-85443; NAS 1.15:85443) Avail: NTIS HC A04/MF A01 CSCL 04B

The present and future use of satellites to locate offshore platforms and relay data from in situ sensors to shore was examined. A system of the ARGOS type will satisfy the increasing demand for oceanographic information through data relay and platform location. The improved ship navigation provided by the Global Positioning System (GPS) will allow direct observation of currents from underway ships. Ocean systems are described and demand estimates on satellite systems are determined. The capabilities of the ARGOS system is assessed, including anticipated demand in the next decade. M.A.C.

**N84-22117*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE INFLUENCE OF GROUND CONDUCTIVITY ON THE STRUCTURE OF RF RADIATION FROM RETURN STROKES**
D. M. LeVine and L. Gesell Feb. 1984 45 p refs
(NASA-TM-86065; NAS 1.15:86065) Avail: NTIS HC A03/MF A01 CSCL 04B

The combination of the finite conductivity of the Earth plus the propagation of the return stroke current up the channel which results in an apparent time delay between the fast field changes and RF radiation for distant observers is shown. The time delay predicted from model return strokes is on the order of 20 micro and the received signal has the characteristics of the data observed in Virginia and Florida. A piecewise linear model for the return stroke channel and a transmission line model for current propagation on each segment was used. Radiation from each segment is calculated over a flat Earth with finite conductivity using asymptotics approximations for the Sommerfeld integrals. The radiation at the observer is processed by a model AM radio receiver. The output voltage was calculated for several frequencies between HF-UHF assuming a system bandwidth (300 kHz) characteristic of the system used to collect data in Florida and Virginia. Comparison with the theoretical fast field changes indicates a time delay of 20 microns. E.A.K.

**N84-22118#** Lightning Location and Protection, Inc., Tucson, Ariz.
**LIGHTNING DATA ANALYSIS Final Technical Report, Jul. 1981 - Jul. 1983**
M. A. Uman Wright-Patterson AFB, Ohio AFWAL Dec. 1983 48 p
(Contract F33615-81-C-3410; AF Proj. 2402)
(AD-A138136; AFWAL-TR-83-3116) Avail: NTIS HC A03/MF A01 CSCL 04/2

A detailed lightning channel reconstruction has been performed for a lightning event recorded as a WC-130 aircraft instrumented for electric and magnetic field measurements was flown in South Florida in the vicinity of a network of groundbased stations that provided wideband electric fields at ground level and data that could be used to determine the location of lightning and VHF sources. Maximum rates of change of airborne electric fields from the last few stepped leader pulses and from the fast field transitions of return strokes are shown to be an order of magnitude smaller than those reported for measurements at ground level over salt water. Two sets of calculations are presented for lightning return stroke electric and magnetic fields at flight altitudes, one set assuming an initial peak current which propagates up the channel unattenuated and the second set assuming a current peak which decreases exponentially with height with a decay length of 1.5 km. A recommendation is given for a lightning return stroke test standard for average first and subsequent return strokes and for a comparison of lightning and EMP. GRA

**N84-22119#** Naval Environmental Prediction Research Facility, Monterey, Calif.
**DIRECTORY OF RESEARCH PUBLICATIONS 5TH EDITION**
Jan. 1984 28 p Supersedes 4th edition dated Jan. 1983, AD-A125506.
(AD-A138224) Avail: NTIS HC A03/MF A01 CSCL 05/2

This directory lists research publications produced by the Naval Environmental Prediction Research Facility (NEPRF) since the command was established in 1971. Abstracts of the last calendar year's publications also are provided. GRA

**N84-22120#** Air Force Geophysics Lab., Hanscom AFB, Mass.
**MODELING CLIMATOLOGY OF AREAL COVERAGE**
I. I. Gringorten 14 Feb. 1984 10 p Presented at the 2nd Intern. Meeting, Statist. Climatol., Lisbon, 26-30 Sep. 1983
(AF Proj. 6670)
(AD-A138276; AD-E950472; AFGL-TR-84-0053) Avail: NTIS HC A02/MF A01 CSCL 04/2

Several stochastic processes have been explored to simulate the areal climatic characteristics of the weather. The success or failure of a model of areal cover, or partial cover, has been judged partly by how well the resulting horizonal field of correlation resembles the natural field. The evaluation of each model, however, is based mostly on its efficiency in approximating the probability distribution of partial or complete coverage, by a weather condition, of an area. Emphasis, in application, is placed on the probability of cloud cover, that should vary from clear or zero cover, to partly cloudy, to overcast or 100% coverage. In addition to the size of the area, the probability distribution is directly related to the horizontal persistence of the weather element, which is parameterized in each model. The parameter is called scale distance. When the model successfully fits the observed areal extent, as viewed by a ground observer, it is then useful in application to other areal dimensions, as might be viewed by a satellite. With each of the several tested models, the snapshot picture of a field can be changed stochastically in a Markov process, simulating thereby a time sequence of weather patterns. Further investigation is well justified. GRA

**N84-22121#** Air Force Environmental Technical Applications Center, Scott AFB, Ill.
**REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO). PARTS A-F: ZARAGOZA AIR BASE, SPAIN Final Report**
9 Dec. 1983 375 p Supersedes USAFETAC/DS-80/089 (AD-A138281; AD-E850504; USAFETAC/DS-83/051; USAFETAC/DS-80/089) Avail: NTIS HC A16/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Zaragoza Air Base, Spain. It contains the following parts: (1) Weather conditions; Atmospheric phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface winds; (4) Ceiling versus visibility; sky cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet bulb and dew point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurring tables. GRA

**N84-22122#** Range Commanders Council, White Sands Missile Range, N. Mex. Meteorology Group.
**ASCENSION ISLAND, SOUTH ATLANTIC RANGE REFERENCE ATMOSPHERE, 0.66 km ALTITUDE Final Report**
Jan. 1984 213 p Supersedes IRIG-104-63-PT-1-ETR (AD-A138470; RCC/MG-371-84; IRIG-104-63-PT-1-ETR) Avail: NTIS HC A10/MF A01 CSCL 04/2

The RRA contains tabulations for monthly and annual means, standard deviations, and skewness coefficients for windspeed, pressure, temperature, density, water vapor pressure, virtual temperature, and dewpoint temperature; the means and standard deviations for the zonal (U) and meridional (V) wind components; and the linear (product moment) correlation coefficient between the wind components. These statistical parameters are tabulated at the station elevation, and 1-km intervals from sea level to 30 km, and at 2-km intervals from 30 to 90 km. The wind statistics are given at approximately 10 m above the station elevations and at altitudes with respect to mean sea level thereafter. For those range sites without rocketsonde measurements, the RRAs terminate at 30 km altitude, or they are extended, if required, when rocketsonde data from a nearby launch site are available. There are four sets of tables for each of the 12 monthly reference periods and the annual reference period. GRA

**N84-22123#** Schmitt (Rainer), Glashutten (West Germany).
**INVESTIGATIONS OF MICRO-TURBULENCE IN THE BOTTOM OF THE BOUNDARY LAYER Interim Report, Jun. - Jul. 1983**
R. Schmitt Jul. 1983 13 p
(Contract DAJA45-83-C-0038; DA Proj. 1T1-61102-BH-57)
(AD-A138524; IR-1) Avail: NTIS HC A02/MF A01 CSCL 04/2

Several sites for the taking of optical turbulence measurements in West Germany have been selected, and the specifications of supporting meteorological instrumentation have been defined. Author (GRA)

**N84-22124#** Department of Energy, Washington, D. C. Office of Basic Energy Sciences.
**CARBON CYCLE RESEARCH PLAN**
Roger C. Dahlman Jan. 1984 40 p refs Prepared in cooperation with ORNL
(Contract W-7405-eng-26)
(DE84-006221; DOE/ER-0188) Avail: NTIS HC A03/MF A01

The development of the ability to estimate change in atmospheric CO2 concentration expected to accompany additional combustion of fossil fuels was investigated. The influence of perturbations (such as forest clearing and climate change) of biogeochemical processes on the global carbon cycle, and the mitigation capacities of natural components of the global carbon system were examined. Providing projections of future changes of atmospheric CO2 are discussed, improved estimates of CO2 uptake by oceans are developed and the role of the biosphere in the global carbon cycle is described. Carbon cycle models will be used to integrate data and to calculate future atmospheric CO2 changes. Evaluation of the fate of the modern fossil CO2 in these reservoirs is emphasized. Fluxes of carbon in the biogeochemical cycle which affect the atmospheric concentration of CO2 and to integrate the empirical data by carbon cycle models in predictive simulations of the fossil perturbation is defined. DOE

**N84-22125#** National Oceanic and Atmospheric Administration, Rockville, Md. Air Resources Labs.
**NOAA PROGRAM FOR DATA ANALYSIS FOR THE FIRST DETECTION OF CO/SUB 2 INDUCED-CLIMATE CHANGE Final Report, 1 Apr. 1982 - 31 Mar. 1983**
1983 6 p
(Contract DE-AI01-82ER-60059)
(DE84-006509; DOE/ER-60059/T1) Avail: NTIS HC A02/MF A01

The development of techniques for the early detection of the CO2 effect on climate are described. The programs include: (1) the feasibility of detecting the effect of CO2 on infrared radiation; (2) expanded analysis of atmospheric temperature trends; (3) changes in atmospheric water vapor; (4) reduction and analysis of high altitude temperature data from the rocketsonde network; and (5) archiving of data from the expanded Air Resources Laboratory trend network. DOE

**N84-22126#** Royal Netherlands Meteorological Inst., De Bilt.
**THE USE OF TRAJECTORIES IN SHORT RANGE WEATHER FORECASTING [HET GEBRUIK VAN TRAJEKTORIEN BIJ EEN KORTE-TERMIJN VERWACHTING]**
P. W. Rosier, J. Reiff, C. J. vanderGoot, and A. Steenhuisen 1983 35 p refs In DUTCH
(KNMI-TR-35) Avail: NTIS HC A03/MF A01

The use of air particle trajectories in weather forecasting was investigated. The trajectory model gives the expected 24 hr trajectory of small air packets arriving at 7000, 850, 700, and 500 mbar using the BK-4 vorticity model for wind fields. The vertical resolution of the expected temperature and humidity profile is 20 mbar, which is much better than that of large scale models. This makes it possible to forecast thin cloud layers. Author (ESA)

**N84-22127#** Royal Netherlands Meteorological Inst., De Bilt. Centrale Weerdienst.
**INVESTIGATION OF THE CHARACTERISTICS OF THE ECMWF MODEL USING THE P27 SYSTEM [EEN ONDERZOEK NAAR EIGENSCHAPPEN VAN HET ECMWF-MODEL M.B.V. HET P27-SYSTEEM]**
R. deBruyn 1983 31 p refs In DUTCH
(KNMI-TR-39) Avail: NTIS HC A03/MF A01

The quality of 500 mbar and ground prognoses using the ECMWF model was investigated. The forecasted circulation types determined with the P27 classification system are compared with model analysis using contingency tables. It is found that the P27 system determines the dominating circulation types per year or per season and is useful for assessing characteristics of the ECMWF model. Author (ESA)

**N84-22128#** Stockholm Univ. (Sweden). Inst. of Meteorology.
**[ACTIVITIES REPORT OF THE INSTITUTE OF METEOROLOGY] Annual Report, Jul. 1982 - Jun. 1983**
Oct. 1983 40 p refs Sponsored by National Swedish Environment Protection Board, Scientific Committee on Problems of the Environment, Swedish Board for Space Activities, Swedish Natural Science Research Council, United Nations Environment Program and WMO
(AR-82-83; ISSN-0349-0068) Avail: NTIS HC A03/MF A01

Research concerning dynamic meteorology, climatology, geophysical fluid dynamics, chemical meteorology; biogeochemistry; the global biogeochemical cycle of carbon; and atmospheric physics is summarized. Condensation and clouds in numerical

models; momentum transfer due to mountains; wet deposition; exchange of gases between atmosphere and vegetation/soil; and tropospheric aerosols were studied. Author (ESA)

**N84-22129#** Royal Netherlands Meteorological Inst., De Bilt. Fysisch Meteorologisch Onderzoek.
**A COMPOUND WEIBULL MODEL FOR THE DESCRIPTION OF SURFACE WIND VELOCITY DISTRIBUTIONS**
P. J. Rijkoort 1983 127 p refs
(KNMI-WR-83-13) Avail: NTIS HC A07/MF A01

A mathematical model to calculate frequency distributions of wind speed for arbitrary locations irrespective of the availability of wind measurements was developed. The model extends the Weibull frequency distribution function with a stability parameter, and applies this to a data base divided into meteorologically homogeneous groups, primarily into daytime and nighttime data. The use of wind data transformed to standard exposure allows a regional analysis and a simplification of the model parameter array. Model parameters computed from the surface wind data of 12 stations were smoothed analytically and graphically. The resulting model was checked with independent wind data from 15 other stations, and is shown to be reliable within the limits of climatological variability. The model is very suitable for the estimation of extreme values of average wind speed for long recurrence periods. Author (ESA)

**N84-22130#** Royal Netherlands Meteorological Inst., De Bilt. Fysisch Meteorologisch Onderzoek.
**DISTORTION OF THE WIND FIELD BY THE CABAUW METEOROLOGICAL TOWER**
H. R. A. Wessels 1983 37 p refs
(KNMI-WR-83-15) Avail: NTIS HC A03/MF A01

Disturbance of measurements of wind direction and velocity at and near a meteorological tower by the tower, a measuring building and various supporting constructions is discussed. Potential flow theory was used to describe the flow around these obstacles and along their downwind wakes. The presence of a wake contributes significantly to the size of the measuring errors. Correction formulas are presented for the data set of the years 1973 to 1984. These results are validated by comparing simultaneous measurements at different instrument positions.
Author (ESA)

**N84-22131#** Massachusetts Inst. of Tech., Cambridge.
**GLOBAL ENERGY AND CO2-INDUCED CLIMATE CHANGE**
D. J. Rose, M. M. Miller, and C. Agnew (Stanford Univ., Calif.) Nov. 1983 238 p refs
(Grant NSF PRA-82-06113)
(PB84-145895; MIT-EL-83-015; MIT-NE-259; NSF/PRA-83036) Avail: NTIS HC A11/MF A01; HC also available in set of 3 as PB84-145887 CSCL 04B

Energy options relevant to lessening the buildup of carbon dioxide (CO2) in the atmosphere in future years, thereby ameliorating the predicted consequent climatological effects, are discussed. The question of energy modeling for an uncertain future is addressed, and methods and long-term energy scenarios are examined, with a focus on highly aggregated global energy-economic models. A set of scenarios is developed, incorporating a range of future energy costs, resource availabilities (including cutoffs and moratoria), and end-use efficiencies. New energy options which are substantially electric are considered, including nuclear, wind, and solar photovoltaic power. The status of electric system integration is explored and the incorporation of energy storage and nondispatchable sources is analyzed. GRA

**N84-22132#** Massachusetts Inst. of Tech., Cambridge. Energy Lab.
**GLOBAL ENERGY FUTURES AND CO2-INDUCED CLIMATE CHANGE, APPENDICES**
D. J. Rose, M. M. Miller, and C. Agnew 1983 105 p refs
(Grant NSF PRA-82-06113)
(PB84-145903; MI-TEL-83-015-App; NSF/PRA-83037-App) Avail: NTIS HC A06/MF A01; HC also available in set of 3 as PB84-145887 CSCL 04B

A list of inputs to the Institute for Energy Analysis Energy Model (the Edmonds-Reilly model), is provided. Parameters include resource constrained technologies, energy service input/output coefficients for oil, gas, coal, and electricity, and renewable resource constrained technologies. Inputs to eleven energy scenarios are presented and global primary energy consumptions in the scenarios are given, along with specified carbon emissions for selected cases. Material requirements for energy technologies and for the scenarios are supplied. The text of the Uniform Transboundary Pollution Reciprocal Access Act is included. GRA

**N84-22133#** Massachusetts Inst. of Tech., Cambridge. Energy Lab.
**GLOBAL ENERGY FUTURE AND CO2 INDUCED CLIMATE CHANGE: EXECUTIVE SUMMARY**
D. J. Rose, M. M. Miller, and C. Agnew (Stanford Univ., Calif.) 1983 18 p refs
(Grant NSF PRA-82-06113)
(PB84-145911; MIT-EL-83-015-ES; MIT-NE-259-ES; NRF/PRA-83038) Avail: NTIS HC A02/MF A01; HC also available in set of 3 as PB84-145887 CSCL 04B

Energy options relevant to improving the buildup of carbon dioxide (CO2) in the atmosphere, thereby ameliorating the consequent climatological effects, are discussed. On the basis of current understanding of the effect of CO2 on climate and trends in global energy use, a significant CO2 warming in the next century cannot be avoided. However, via the adoption of alternative forms of energy, the rate of increase of atmospheric CO2 due to fossil fuel consumption can be significantly reduced. With the trend toward a more electric world, electric systems should be thoroughly investigated. More thought should be given to nuclear power, which costs significantly less than coal power. The use of wind power in selected regions is suggested, and the need to reduce energy consumption is emphasized. GRA

**N84-22134#** National Center for Atmospheric Research, Boulder, Colo.
**CASE STUDIES ON CONVECTIVE STORMS, CASE STUDY 1, 13 JULY 1978: FIRST ECHO CASE**
Daniel W. Breed Nov. 1983 195 p refs Sponsored in part by National Science Foundation
(PB84-147479; NCAR/TN-220) Avail: NTIS HC A09/MF A01 CSCL 04B

On 13 July 1978, a long-lived storm complex developed in southeastern Wyoming, and was well observed by aircraft and radars. The potential instability was weak to moderate on this day, and the environmental shear was fairly strong, resulting in an airmass thunderstorm of multi-cellular character. Data from the many penetrations by instrumented aircraft charactearize various stages of development of seven cells that formed on the storm's western flank. Cloud particle sizes and types suggest accretion (riming) as the dominate particle growth mode. The study focuses on first-echo formation and cell development, though the major cells formed a moderately intense storm which lasted for several hours. Author (GRA)

**N84-22135#** National Academy of Sciences - National Research Council, Washington, D. C. Carbon Dioxide Assessment Committee.
**CHANGING CLIMATE Final Report**
1983 521 p refs Sponsored in part by the Office of Science and Technology Policy
(PB84-148576; ISBN-0-309-03425-6; LC-83-62680) Avail: NTIS HC A22/MF A01 CSCL 04B

Scientists have known for many years that CO2 plays an important role in determining the Earth's temperature. CO2 in the atmosphere is transparent to incoming energy rays from the Sun but absorbs heat energy from the Earth qnd radiates heat back to the Earth's surface. This phenomenon, often called the greenhouse effect, means that increasing levels of CO2, in the atmosphere will cause increases in the average temperatures of the Earth. Continued use of fossil fuels will most likely double

atmospheric CO2 concentrations by late in the next century, possibly causing worldwide temperature increases and serious climate changes, the committee concluded. GRA

**N84-22136#** National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Data Referral Service.
**NORTH AMERICAN CLIMATIC DATA CATALOG, PART 1**
Jan. 1984 623 p
(PB84-150366; NEDRES-1-Pt-1; NOAA-84011901-Pt-1) Avail: NTIS HC A99/MF A01 CSCL 04B

The North American Climatic Data Catalog contains descriptions of a variety of atmospheric data sets. Included are surface and upper air meteorological data and statistically derived climatological parameters; satellite data; atmospheric radiation, physics, and chemistry data; air quality measurements; oceanographic studies containing data relevant to climatic research; and proxy data used in paleoclimatological studies. The data sources include organizations at all levels of government, universities, private companies, and contains two major sections, the data inventory and the indexes. The inventory section lists and describes sources in alphabetical order. GRA

**N84-22137#** National Climate Program Office, Rockville, Md.
**PROCEEDINGS OF THE CONFERENCE ON COOPERATIVE CLIMATE SERVICES**
H. L. Hill, comp. Oct. 1983 232 p refs Conf. held in Tallahassee, 22-24 Mar. 1983
(PB84-152081; NOAA-84012002) Avail: NTIS HC A11/MF A01 CSCL 04B

Options for public/private cooperation in providing regional, state and local climate services are evaluated. Aspects of these options include: (1) federal agency roles in providing climate services; (2) specialized climate services provided by the public and private sectors; (3) regional and state climate centers and survey of state climatologists; (4) technology support for state and regional climate centers. GRA

# 48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

**N84-22138*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**DESCRIPTION OF ALGORITHMS FOR PROCESSING COASTAL ZONE COLOR SCANNER (CZCS) DATA**
Philip M. Zion 15 Dec. 1983 34 p refs
(Contract NAS7-100)
(NASA-CR-173466; JPL-Pub-83-98; NAS 1.26:173466) Avail: NTIS HC A03/MF A01 CSCL 08J

The algorithms for processing coastal zone color scanner (CZCS) data to geophysical units (pigment concentration) are described. Current public domain information for processing these data is summarized. Calibration, atmospheric correction, and bio-optical algorithms are presented. Three CZCS data processing implementations are compared. E.A.K.

**N84-22139#** Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
**STRESSES IN A SUBMARINE TOPOGRAPHY UNDER OCEAN WAVES**
Chiang C. Mei and David F. McTigue (SNL) 1984 12 p refs Presented at the ASME Energy Sources Technol. Conf. and Exhibition, New Orleans, 12 Feb. 1984
(Contract DE-AC04-76DP-00789; Grant NSF CME-79-21993)
(DE84-005722; SAND-84-0024C; CONF-840201-9) Avail: NTIS HC A02/MF A01

Submarine slope stability which is of interest to both offshore engineering and geology was studied. In an uneven topography, the weight above a horizontal plane induces two dimensional variation in the static stress field. The action of wave pressure, which changes with depth, further introduces excess pore pressure and dynamic stresses in the sea bottom. An analytical theory for the static stress and the solution for wave induced stresses in a plane poro-elastic sea bed to account for mild bottom slope and wave shoaling, to obtain the effective stress field in a submarine topography under sea waves were combined. Sample results are given for a ridge and a canyon. The dynamic pore pressure and the combined static and dynamic effective stresses are presented. DOE

**N84-22140#** Puerto Rico Univ., Mayaguez. Center for Energy and Environment Research.
**GENERATION OF MESOSCALE HYDRODYNAMIC PHENOMENA BY THE GRAPPLER AND WHITING SEAMOUNTS, SOUTHEAST OF PUERTO RICO**
Jorge E. Capella 1983 125 p refs
(PB84-148196; CEER-M-162) Avail: NTIS HC A06/MF A01 CSCL 08C

Topographically generated mesoscale eddies in the region of the Grappler and Whiting Seamounts which are located 22km southeast of Puerto Rico were investigated. Three different data sets were used: (1) site specific hydrographic data; (2) satellite images from TIROS/NOAA, LANDSAT and Skylab satellites; and (3) free drifting drogued-buoy tracks. The hydrographic and drogue data definitively establish the presence of perturbations over the seamounts which are qualitatively consistent with model predictions. Closed contour regions in the distribution of dynamic heights, temperature, salinity, and dissolved oxygen were found in the surface and subsurface waters above the top of Grappler Seamount. A cyclonic eddy like feature located close to Grappler Seamount, in the satellite images, suggests that eddies are shed from the seamount region. GRA

# 51 LIFE SCIENCES (GENERAL)

Includes genetics.

**N84-22141#** Washington Univ., Seattle. Bioelectromagnetics Research Lab.
**EFFECTS OF LONG-TERM LOW-LEVEL RADIOFREQUENCY RADIATION EXPOSURE ON RATS. VOLUME 4: OPEN-FIELD BEHAVIOR AND CORTICOSTERONE Final Report, 1 Jun. 1980 - 31 Jan. 1983**
R. B. Johnson, D. Spackman, J. Crowley, D. Thompson, and C. K. Chou Dec. 1983 47 p
(Contract F33615-80-C-0612; AF Proj. 7757)
(AD-A137743; USAFSAM-TR-83-42) Avail: NTIS HC A03/MF A01 CSCL 06/18

No significant alterations in overall behavioral response or corticosterone content were apparent in rats after 2 years of exposure to pulsed-microwave radiation. A reduction in open-field activity by the exposed animals during the first assessment period correspond with an increase in serum corticosterone. GRA

**N84-22142#** Charles F. Kettering Research Lab., Yellow Springs, Ohio.
**PARTICULATE MODELS OF PHOTOSYNTHESIS**
G. R. Seely Nov. 1983 15 p
(Contract DE-AC02-82ER-12039)
(DE84-003947; DOE/ER-12039/1) Avail: NTIS HC A02/MF A01

The photochemical and photophysical properties of chlorophyll adsorbed together with various surfactants to particles of polyethylene swollen with low molecular weight hydrocarbon diluents were studied. The objectives of the program are to: (1) discover and optimize photochemical reactions for separation of oxidized and reduced products into different phases; (2) further characterize association of chlorophyll and other amphiphilic substances on the particle surface; and (3) improve the methods of studying photoprocesses in optically dense scattering media. An analog of photosystem of photosynthesis will be developed, in which quinones will be reduced in the particle phase, and reductants

oxidized in the aqueous suspending phase. Diacylindigos will be investigated as all purpose probes for photoprocesses in heterogeneous systems. It is shown that the forms of chlorophyll association are specific to the surfactant, that the chlorophyll species are often strongly fluorescent at room temperature, and that the particular systems are capable of a vigorous and sometimes novel photochemistry. DOE

**N84-22143#** Department of Energy, Washington, D. C. Div. of Electric Energy Systems.
**BIOLOGICAL EFFECTS FROM ELECTRIC FIELDS ASSOCIATED WITH HIGH VOLTAGE TRANSMISSION LINES Abstracts Only**
Nov. 1983 46 p Presented at the DOE Contractors Review of Elect. Field Effects, Kansas City, Mo., 7 Nov. 1983 Prepared in cooperation with EPRI, Palo Alto, Calif.
(DE84-005498; CONF-831161-Absts) Avail: NTIS HC A03/MF A01

The biological effects from electric fields were investigated. Investigations are summarized with objectives, accomplishments of the past year, and some indication of projected studies. DOE

**N84-22144#** Pacific Northwest Lab., Richland, Wash. Biology and Chemistry Dept.
**BIOLOGICAL EFFECTS OF ELECTRIC FIELDS: AN OVERVIEW**
Larry E. Anderson and Richard D. Phillips Nov. 1983 36 p refs Presented at the Intern. School of Radiation Damage and Protection: Biological Effects and Dosimetry of Non-ionizing Radiation, Erice, Italy, 15-25 Nov. 1983
(Contract DE-AC06-76RL-01830)
(DE84-005888; PNL-SA-11781; CONF-831138-1) Avail: NTIS HC A03/MF A01

A cursory overview of investigations on the biological consequences of exposure to ELF electromagnetic fields is presented. Three topics are discussed, including: (1) the general methodology of exposure experiments, including those elements which are critical for definitive studies in biological systems; (2) a discussion of epidemiological and clinical studies conducted to date; and (3) a more extensive examination of animal experiments representing major areas of investigation (behavior, biological rhythms, nervous and endocrine systems, bone growth and repair, cardiovascular system and blood chemistry, immunology, reproduction, growth and development mortality and pathology, cellular and membrane studies, and mutagenesis). Current concepts, possible mechanisms and future directions of research are presented. DOE

**N84-22145#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: LIFE SCIENCES, BIOMEDICAL AND BEHAVIORAL SCIENCES**
15 Feb. 1984 74 p Transl. into ENGLISH from Various Russian Repts., May - Jun. 1983 p 1-61
(JPRS-UBB-84-003) Avail: NTIS HC A04

Mixtures of herbicides, growth retardants and fertilizers are used in regulating growth and maturation, however many nutrients are utilized by weeds instead of the target crop. Good results were obtained with barley using chlorocholine chloride-dihydrel mixtures. A fertilizer of N120P90K90 was applied and show lodging reduction by a factor of 1.5 to 2.5 with various mixtures was shown and a 4 : 1 mixture of ingredients brought nearly complete elimination of lodging. Separate applications of growth regulators had no appreciable effect, while the mixtures had a clear synergistic effect. Overall yield and protein content of the wheat growth was increased with the mixture. Various mixtures of retardants and fertilizers and the study of their manufacture and application are recommended. E.A.K.

## 52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

**N84-22146*** National Aeronautics and Space Administration, Washington, D. C.
**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 257**
Apr. 1984 96 p
(NASA-SP-7011(257); NAS 1.21:7011(257)) Avail: NTIS HC $7.00 CSCL 06E

This bibliography lists 331 reports, articles and other documents introduced into the NASA scientific and technical information system in March 1984. Author

**N84-22147#** Royal Observatory, Edinburgh (Scotland).
**WORK AT HIGH ALTITUDE: A CLINICAL AND PHYSIOLOGICAL STUDY AT THE UNITED KINGDOM INFRARED TELESCOPE, MAUNA KEA, HAWAII**
Peter J. G. Forster 1983 99 p refs
(Rept-11; ISSN-0309-099X) Copyright. Avail: Issuing Activity

The 3.8m United Kingdom Infrared Telescope (UKIRT) is sited at the summit of Mauna Kea (4,200). Staff manning the telescope reside at sea level. While living on the mountain, staff eat and sleep at the midlevel facility of Hale Pohaku (3,000 m; 9,270 ft.). Telescope personnel represent a unique population exposed to the stress of hypoxia. From previous studies of sea-level residents ascending to high altitudes, the staff should be acutely susceptible to altitude-related illness. In addition to the effects of hypoxia, astronomers may be subject to physiological disturbances due to a reversal of diurnal rhythms. Results of the medical examinations are presented. B.G.

**N84-22148** Ohio State Univ., Columbus.
**CARDIAC SWIMMING AND A TRADITIONAL REHABILITATION PROGRAM OF BIKE-WALK-JOG; A COMPARISON OF MAXIMAL OXYGEN CONSUMPTION AND STRENGTH Ph.D. Thesis**
Kevin Timothy Kear 1983 133 p
Avail: Univ. Microfilms Order No. DA8400232

In an attempt to determine the changes in maximal oxygen consumption and strength proceeding a three month training program using the mode of swimming, two groups of cardiovascular disease high risk patients were studied. Group B consisted of post myocardial infraction (MI), post coronary artery bypass graft (CABG) or high risk patients at least three months after the event. Their mode of exercise was a walk-jog program in The Ohio State University's Phase 2 Cardiac Rehabilitation Program. Group A consisted of patients who first went through at least one week of the walk-jog program and then volunteered for the swimming program. Both groups underwent a maximal oxygen consumption graded exercise test on a treadmill using the Balke (Special) Protocol. Exercise prescriptions were based on 60-75% of maximal oxygen consumption at corresponding heart rates. For strength testing the Cybex II was used to measure muscle strength, measured in peak torque at 90 degrees per second. The joints tested were the right and left knee, shoulder, and elbow.
Dissert. Abstr.

**N84-22149#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 18, NO. 1, JANUARY - FEBRUARY 1984**
4 Apr. 1984 18 p refs Transl. into ENGLISH of Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 18, no. 1, Jan. - Feb. 1984
(JPRS-USB-84-002) Avail: NTIS HC A02

The tonus of antigravity muscles of subjects in different age groups under simulated weightlessness is discussed. Highlights of papers presented at the 13th annual Gagarin Conference on Aviation and Cosmonautics are included with emphasis on the effects of long term space flight on man. For individual titles, see N84-22150 through N84-22151.

**N84-22150#** Joint Publications Research Service, Arlington, Va.
**MUSCLE TONE CHANGES IN INDIVIDUALS OF DIFFERENT AGE GROUPS SUBMITTED TO SIMULATED WEIGHTLESSNESS**
V. G. Kozlova and Y. A. Ilina *In its* USSR Rept.: Space Biol.

and Aerospace Med., V. 18, No. 1, Jan. - Feb. 1984 (JPRS-USB-84-002) 4 Apr. 1984 p 3-6 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 18, no. 1, Jan. - Feb. 1984 p 90-92 (For primary document see N84-22149 12-52)
Avail: NTIS HC A02

Water immersion with dry submersion was used to simulate weightlessness in tests conducted on 24 men between 30 and 49 years of age. Immersion lasted 7 days. Muscle tone was tested on the basis of evaluating the firmness of muscle tissues before and during water immersion hypokinesia on the 1st, 3rd, and 7th days. Tonometry of crural muscles and thigh was performed under standard conditions at rest. A tonomyometer was used that is based on consideration of the correlation between resilient deformation which occurs upon measured depression of the skin at the point of projection of the tested muscle and the tension of this muscle. Student's variational statistical method was applied. Results are shown in tables and indicate changes in the same direction in muscle tone in subjects of different age groups. The factor of repeated immersion is of decisive significance. A.R.H.

**N84-22151#** Joint Publications Research Service, Arlington, Va.
**THIRTEENTH GAGARIN CONFERENCE**
A. A. Gyurdzhian, S. M. Ledovskoy, and V. I. Savchenko *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 18, No. 1, Jan. - Feb. 1984 (JPRS-USB-84-002) 4 Apr. 1984 p 7-13 Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 18, no. 1, Jan. - Feb. 1984 p 92-95 Conf. held in Moscow, 4-8 Apr. 1983 (For primary document see N84-22149 12-52)
Avail: NTIS HC A02

Cosmonaut experience in training and participating in the 211 day Salyut-7 mission; space monitoring of anthropogenic factors and related effects; and medical findings from the longest manned space flight to date are discussed. Papers delivered at the biomedical sessions of the 13th Gagarin Congerence are summarized. Topics cover: (1) psychophysiology of operator performance; (2) effect of flight factors on the body; (3) symptomatology, expertise, and nutrition; and (4) gravity biology. Problems in studying plant life in weightlessness; a model of a man-Chlorella-mineralization system for studying biological and abiotic relations; and a device for transmitting via a single channel the indicators of pulse and respiration rate, dynamics of cardiac output, and coronary blood flow are described. The protection of passengers and crew from sonic booms and from low humidity in civil aviation aircraft is also explored. A.R.H.

**N84-22152#** Federal Aviation Administration, Washington, D.C.
**A HAZARD IN AEROBATICS: EFFECTS OF G-FORCES ON PILOTS**
28 Feb. 1984 12 p
(FAA-AC-91-61) Avail: NTIS HC A02/MF A01

Background information on gravitational effects (G's), their effect on the human body, and their role in safe flying are discussed. Suggestions are offered for avoiding problems caused by accelerations encountered in aerobatic maneuvers. These include familiarization with aerobatic maneuvers, easing off of the controls when reaching tolerance limits, consultation with a knowledgeable flight surgeon, maintaining good physical fitness, and knowledge of methods that reduce the effects of acceleration. M.A.C.

**N84-22153#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PHYSIOLOGICAL DATA ACQUISITION SYSTEM AND MOTION SICKNESS PREVENTION TRAINER M.S. Thesis**
O. A. Earl and C. N. Peterson Dec. 1983 140 p Original contains color illustrations
(AD-A138361; AFIT/GE/EE/83D-19) Avail: NTIS HC A07/MF A01 CSCL 06/19

A physiological data acquisition system and rotating chair were erected to allow future studies on the prevention of motion sickness induced by coriolis stimulation. Physiological monitoring equipment to measure pulse-to-pulse heart rate, gastric motility, respiration rate, and skin pallor were designed and built. This physiological monitoring equipment and commercially available equipment which measures skin surface temperature, galvanic skin reflex (GSR), and electomyogram (EMG) of superficial muscles were integrated into a programmable digital data acquisition system. The programmable digital data acquisition system provides equivalent digital values for the analog outputs of the monitoring equipment at time intervals which can be chosen by an experimenter. These digital values are transmitted from the chair, through sliprings, to an output port where the signal processing and data recording equipment can be attached. GRA

**N84-22154#** Environmental Health Lab., Wiesbaden, APO New York 09220.
**INDUSTRIAL HYGIENE DATA FOR F-16 AIRCRAFT REFUELING INSIDE CLOSED AIRCRAFT SHELTERS. SUPPLEMENTARY Final Technical Report, May - Jul. 1983**
J. A. Martone and D. J. Hawkins Jul. 1983 11 p Previously announced as N82-28994
(AD-A138364; EHL(W)-TR-83-13) Avail: NTIS HC A02/MF A01 CSCL 01/3

This report supplements EHL(W) TR 83-08, An Industrial Hygiene Evaluation of F-16 Aircraft Refueling Inside Closed Aircraft Shelters. This study considers F-16 refueling inside third generation shelters using JP-8 was well as JP-4 fuel. The position of the fuel truck differed from previous work. Workplace concentrations of fuel vapors, carbon monoxide, and benzene were measured. The conclusion is that F-16 refueling in third generation shelters need not be limited because of industrial hygiene considerations. GRA

**N84-22155#** Naval Biodynamics Lab., New Orleans, La.
**CURRENT RESEARCH AT THE U.S. NAVAL BIODYNAMICS LABORATORY ON HUMAN WHOLE-BODY MOTION AND VIBRATION**
J. C. Guignard, A. C. Bittner, Jr., and M. M. Harbeson Jul. 1983 24 p Presented at the Meeting of the United Kingdom Informal Group, Human Response to Vibration in London, Sep. 1982
(M00-96-PN; F58-524)
(AD-A138367; NBDL-83R008) Avail: NTIS HC A02/MF A01 CSCL 06/19

This report provides an overview of recent, ongoing, and planned whole-body motion and vibration research at the Naval Biodynamics Laboratory. Three interrelated efforts are reviewed: (1) Performance Evaluation Tests for Environmental Research; (2) the development of experimental paradigms and statistical methodologies; and (3) identification of vibration effects on performance. Three studies in which performance tasks were administered under various levels of vibration are summarized. A program to assess human whole-body vibration effects is under way at the Naval Biodynamics Laboratory (NBDL). This program, together with affiliated ship-motion and impact-acceleration programs, is directed at establishing correlations between psychological, physiological, and biodynamic (inertial) responses of human volunteer subjects. Mechanical input forces of interest across programs ar the kind experienced in ship and aircraft crewstations. Recent research has been directed at the developement of experimental paradigms, statistical methodologies, and strategic plans for systematic explorations of pertinent parameters of the motion environment. Results of th vibration program suggest: using repeated measures methodologies; (2) experimental focus on mechanical interference with input (e.g., visual) and output (e.g., motor) processes; and (3) study of the nature of performance changes during repeated and longer-term exposures. Ongoing and future research efforts are aimed at these recommendations.
Author (GRA)

**N84-22156#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**THE APPLICATION OF A SUPERCONDUCTING QUANTUM INTERFERENCE DEVICE SECOND-ORDER GRADIOMETER TO MEASURE VISUAL EVOKED RESPONSES M.S. Thesis**
R. D. Murray Dec. 1983 171 p
(AD-A138407; AFIT/GE/EE/83D-50) Avail: NTIS HC A08/MF A01 CSCL 06/16

The acquisition of a Superconducting Quantum Interference Device (SQUID) gradiometer, along with the previous research which led to the first cortical implant of a multiplexed multi-electrode semiconductor brain electrode, motivated the use of the SQUID second-order gradiometer to measure visual evoked responses (VER) from humans, and from the canine which had previously had the AFIT brain electrode implanted and removed. Some discussion of the current dipole model for the fields measured from the brain is presented. The human visual evoked responses picked up by gradiometer were compared to previous human electroencephalograph visual evoked responses, and were found to have similar latencies. The canine visual evoked responses which were measured by the gradiometer had similar initial waveform and latencies, but then dampen out more rapidly than the waveforms measured by the AFIT brain chip. Conclusions about the use of a SQUID gradiometer in measuring visual evoked responses, along with comparisons between the EEG and AFIT brain chip data versus the SQUID data is discussed. GRA

**N84-22157#** Environmental Health Lab., Wiesbaden, APO New York 09220.
**AN INDUSTRIAL HYGIENE EVALUATION OF F-16 AIRCRAFT REFUELING INSIDE CLOSED AIRCRAFT SHELTERS Final Report, Mar. - Jun. 1983**
J. A. Martone Jul. 1983 24 p
(AD-A138501; EHL(W)-TR-83-08) Avail: NTIS HC A02/MF A01 CSCL 01/3

This study is an industrial hygiene evaluation of F-16 aircraft refueling in closed first generation hardened aircraft shelters; it supplements BEES(W) Technical Reports 81-03 and 81-42. The primary concern is with breathing zone concentrations of fuel vapors displaced from the aircraft fuel tanks during refueling. In-shelter F-16 integrated combat turns are also assessed. The major conclusion is that in-shelter F-16 refueling can be performed without limitation. For the case of integrated combat turns, short term exposure limits to carbon monoxide, nitrogen dioxide, and nitric oxide are not exceeded but full workday average carbon monoxide exposure is a potential limitation that requires further study. GRA

**N84-22158#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Afd. Audiologie.
**MOTION SICKNESS [BEWEGINGSZIEKTZ]**
W. Bless Oct. 1983 43 p refs In DUTCH; ENGLISH summary
(IZF-1983-21; TDCK-78679) Avail: NTIS HC A03/MF A01

The functions of the vestibular, visual, and somatosensory systems in gathering information on spatial orientation and on the effects of sensory interactions are discussed. It is concluded that incongruent sensory information may lead to motion sickness. The concept of an intersensory mismatch is applied to several manifestations of motion sickness such as sea sickness, air sickness, and car sickness. Individual susceptibility to, prevention of, and adaptation to motion sickness, as well as theoretical applications are considered. Author (ESA)

**N84-22159#** Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
**TOXICOLOGY OF TETRACHLOROETHYLENE**
D. M. W. Elskamp Jan. 1983 38 p refs In DUTCH; ENGLISH summary
(MBL-1983-3; TDCK-77771) Avail: NTIS HC A03/MF A01

Literature on the toxic characteristics of tetrachloroethylene was reviewed. Technical data, environmental and biological monitoring, toxicokinetics, and data of acute and chronic toxicity for laboratory animals and humans are given. The effects on reproduction, and mutagenic and carcinogenic effects are discussed. Author (ESA)

**N84-22160#** Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
**TOXICOLOGY OF STYRENE**
D. M. W. Elskamp Apr. 1983 50 p refs In DUTCH; ENGLISH summary
(MBL-1983-11; TDCK-77816) Avail: NTIS HC A03/MF A01

Literature on the toxic characteristics of styrene was reviewed. Technical data, environmental and biological monitoring, toxicokinetics, and data of acute and chronic toxicity for laboratory animals and humans are given. The effects on reproduction, and mutagenic and carcinogenic effects are discussed. Author (ESA)

**N84-22161#** PEDCo-Environmental, Inc., Durham, N.C.
**A STUDY OF PERSONAL EXPOSURE TO CARBON MONOXIDE IN DENVER, COLORADO**
Ted Johnson Jan. 1984 290 p
(Contract EPA-68-02-3755)
(PB84-146125; EPA-600/4-84-014) Avail: NTIS HC A13/MF A01 CSCL 06T

Noninstitutionalized, nonsmoking residents of the urbanized portion of the metropolitan area who were between 18 and 70 years were studied for exposure to carbon monoxide. Each participant carried a personal exposure monitor (PEM) and an activity diary for two consecutive 24 hour sampling periods and provided a breath sample at the end of each sampling period. Approximately 900 person days of PEM and activity diary data were analyzed and it was found that personal CO exposures were higher in microenvironments associated with motor vehicles such as parking garages and automobiles. GRA

# 53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**N84-22162*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**A USER-ORIENTED AND COMPUTERIZED MODEL FOR ESTIMATING VEHICLE RIDE QUALITY**
Jack D. Leatherwood and Linda M. Barker (System Development Corp., Hampton, Va.) Apr. 1984 45 p refs
(NASA-TP-2299; L-15745; NAS 1.60:2299) Avail: NTIS HC A03/MF A01 CSCL 05H

A simplified empirical model and computer program for estimating passenger ride comfort within air and surface transportation systems are described. The model is based on subjective ratings from more than 3000 persons who were exposed to controlled combinations of noise and vibration in the passenger ride quality apparatus. This model has the capability of transforming individual elements of a vehicle's noise and vibration environment into subjective discomfort units and then combining the subjective units to produce a single discomfort index typifying passenger acceptance of the environment. The computational procedures required to obtain discomfort estimates are discussed, and a user oriented ride comfort computer program is described. Examples illustrating application of the simplified model to helicopter and automobile ride environments are presented. E.A.K.

**N84-22163#** Oklahoma Univ., Norman. Decision Processes Lab.
**RESEARCH AND THEORY ON PREDECISION PROCESSES Final Report, 15 Aug. 1980 - 30 Sep. 1983**
Charles F. Gettys 30 Nov. 1983 100 p
(Contract N00014-80-C-0639; NR Proj. 197-066)
(AD-A137962; TR-11-30-83) Avail: NTIS HC A05/MF A01 CSCL 05/10

This monograph discusses six years of research and theory building at the Decision Processes Laboratory concerned with predecision processes, the cognitive processes that occur prior to making the actual decision. These processes include problem detection, the process by which the decision maker decides that a problem exists; act generation, the process of creating candidate acts that might solve the problem, hypothesis generation where various states of the world are identified that might affect the outcomes of various actions; and outcome generation, a process

where the possible results or outcomes of actions are generated. There are nine substantive chapters in the monograph. The first five chapters are concerned with modeling the various predecision processes and describe the empirical research that addresses these models. Chapter 6 is devoted to research on various topics such as schemata, causal explanation, small group research, individual differences, and expertise in various predecision processes. Chapter 7 discusses recommendations for improving predecision performance, including specific attempts to aid the decision maker, and Chapter 8 presents, in summary form, the major conclusions of this program of research. In Chapter 9, general suggestions are made for further research in the area. GRA

**N84-22164#** Michigan State Univ., East Lansing. Dept. of Psychology.
**OPERATIONALIZING HALO: PROBLEMS WITH THE COMPUTATION OF A STANDARD DEVIATION ACROSS DIMENSIONS WITHIN RATES Interim Technical Report**
E. D. Pulakos and N. Schmitt Jan. 1984 20 p
(Contract N00014-83-K-0756)
(AD-A138393; TR-84-1; Rept-2003) Avail: NTIS HC A02/MF A01 CSCL 05/10

The use of a standard deviation across rating dimensions for each rate as a measure of halo is criticized for those cases in which the average of the ratings on each dimension is not equal. Standardizing the data within each dimension prior to computing the standard deviation across dimensions corrects this problem. Further, an example is presented in which this standardized standard deviation is shown to be correlated nearly 1.00 with the average intercorrelation among rating dimensions and the average difference between the true and observed dimension intercorrelations. Correlations between the commonly used unstandardized standard deviation and the other operationalizations of halo were approximately .80. GRA

**N84-22165#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Traffic Behavior Group.
**TIME TO LINE CROSSING (TLC): A NEW METHOD TO DESCRIBE DRIVING PERFORMANCE**
J. Godthelp, P. Milgram, and G. J. Blaauw Jul. 1983 22 p refs
(IZF-1983-10; TDCK-78190) Avail: NTIS HC A02/MF A01

The time to line crossing (TLC) concept (which represents the time before an automobile reaches either edge of the driving lane, assuming a fixed steering strategy) was used to describe driving as a task in which closed loop strategies can be alternated with open loop periods. Subjects drove a straight roadway at different speed levels and under conditions of temporary, self chosen occlusion periods. The results show that lateral position control and looking strategy can very well be explained in terms of the TLC data. It is also shown how a combination of the driver's self chosen occlusion times and TLC may lead to a better understanding of the driver's strategy. Author (ESA)

**N84-22166#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Experimental Psychology Group.
**SOCIETAL VERSUS INDIVIDUAL DECISION MAKING: HOW THEY MIGHT DIFFER**
S. Lichtenstein and W. A. Wagenaar Oct. 1983 43 p refs
(IZF-1983-20; TDCK-78678) Avail: NTIS HC A03/MF A01

The situation in which a societal decision maker (SDM) is responsible for making decisions whose effects fall primarily or exclusively on other people is discussed. The causes of differences between the decisions made by the SDMs and the preferences of the affected individuals and ways to resolve such discrepancies are considered. Discrepancies are traced to different perspectives on the problem, different values, or differences in the customary methods that people use when making decisions. For resolving decision discrepancies, the SDM should first make the decision and then, before implementing it, make a meta-analysis of that decision and its potential for generating disagreements. Once the possible source or sources of disagreements are found, resolution can be sought. Author (ESA)

**N84-22167#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Traffic Behavior Group.
**OPEN AND CLOSED LOOP STEERING IN A LANE CHANGE MANEUVER**
J. Godthelp, A. R. A. vanderHorst, S. Burrij, and C. vandeLagemaat Nov. 1983 36 p refs
(IZF-1983-22; TDCK-78680) Avail: NTIS HC A03/MF A01

Car steering during a lane change was analyzed as a precognitive control task, with and without occlusion to test the hypothesis that the dependency on instantaneous visual feedback is low during precognitive steering. Results show that variability in steering wheel movement amplitude increases linearly with movement amplitude, and is equal with and without occlusion. A tendency to overshoot the steering wheel movement amplitudes without visual feedback is only confirmed for maneuvers with small steering wheel movement amplitudes. A tendency to reproduce steering wheel movements too slowly under conditions without visual feedback is not confirmed. Rather than affecting the variability in steering wheel amplitude and timing separately, the withdrawal of visual feedback deteriorates the mutual tuning of these quantities. Author (ESA)

# 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**N84-22168*#** Rochester General Hospital, N. Y. Dept. of Surgery.
**DEVELOPMENT AND MARKETING OF A PROSTHETIC URINARY CONTROL VALVE SYSTEM Final Report, Jan. 1978 - Dec. 1983**
John B. Tenney, Ronald Rabinowitz, David W. Rogers, and Howard N. Harrison Dec. 1983 237 p refs
(Contract NAS8-32815)
(NASA-CR-170994; NAS 1.26:170994) Avail: NTIS HC A11/MF A01 CSCL 05H

An implantable prosthetic for the control of urinary incontinence was developed and marketed. Three phases are presented: bench development studies, animal trials, and human clinical trials. This work was performed under the direction of a Research Team at Rochester General Hospital (RGH). Bench trials were completed on prototype hardware and provided early verification of the device's ability to withstand repeated cyclic testing. Configurational variants were evaluated and a preferred design concept was established. Silicone rubber (medical grade) was selected as the preferred material for the prosthesis. Author

**N84-22169*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**DOSE IN CRITICAL BODY ORGANS IN LOW EARTH ORBIT**
John W. Wilson and Frank Cucinotta (Old Dominion Univ.) Apr. 1984 35 p refs
(NASA-TM-85778; NAS 1.15:85778) Avail: NTIS HC A03/MF A01 CSCL 06R

Human exposure to trapped radiations in low Earth orbit (LEO) are evaluated on the basis of a simple approximation of the human geometry for spherical shell shields of varying thickness. A data base is presented that may be used to make preliminary assessment of the impact of radiation exposure constraints on human performance. A sample impact assessment is discussed. Author

**N84-22170#** Army Aeromedical Research Lab., Fort Rucker, Ala. Biodynamics Research Div.
**UH-60 SHOULDER HARNESS LEAD-IN STRAP FAILURE ANALYSIS**
Ted A. Hundley Oct. 1983 23 p
(DA Proj. 3E1-62777-A-878)
(AD-A138014; USAARL-84-1) Avail: NTIS HC A02/MF A01 CSCL 01/3

Shoulder harness lead-in strap failures have occurred in several

UH-60 Blackhawk helicopter accidents with crewmembers being injured as a result. An investigation into possible failure causes was conducted. The two most likely causes found were incorrect installation of the seat insert guide and an increase in stress in the lead-in strap caused by the radius of bend at the point where the strap passes through the seat back. Test showed that incorrect installation of the seat insert guide caused a significant reduction in the failure load of the webbing. Tests also showed that a reduction in failure load occurred when the webbing was pulled over a radiused corner. The first problem was solved by removing and reinstalling the seat insert guides. The second problem can be dealt with by using a higher-strength lead-in strap. GRA

**N84-22171#** Army Aeromedical Research Lab., Fort Rucker, Ala.
**COMPARISON OF REAL-EAR ATTENUATION CHARACTERISTICS OF THE STANDARD SPH-4 EARCUP AND A PROTOTYPE CRUSHABLE EARCUP**
B. T. Mozo and W. R. Nelson Dec. 1983 24 p
(DA Proj. 3E1-62777-A-878)
(AD-A138042; USAARL-84-2) Avail: NTIS HC A02/MF A01 CSCL 06/17

The use of the SPH-4 aviator's helmet in the Army is to provide hearing protection, voice communications, and head protection against impact. Efforts have been made recently to improve protection in the region of the earcup. In 1977, USAARL contracted with Simula Incorporated to develop an earcup which would provide greater energy absorption on impact and still provide sound attenuation equivalent to the current standard earcup. A prototype has been submitted for evaluation of noise attenuation and comparison to the current standard earcup. The crushable earcup was found to provide greater hearing protection at most test frequencies. GRA

**N84-22172#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PSC, A PROGRAMMABLE SOFTWARE CONTROLLER FOR A MULTIPLE BLADDER, SEQUENTIALLY INFLATABLE G-SUIT M.S. Thesis**
J. L. Marcu Dec. 1983 180 p
(AD-A138069; AFIT/GE/EE/83D-41) Avail: NTIS HC A09/MF A01 CSCL 06/11

A bang-bang closed loop digital programmable controller was developed for a multiplebladder sequentially inflatable g-suit. Programmable parameters included the number of bladders, sequence of inflation, PSI/G relationship, and a g-suit refresh cycle. The software was developed in BASIC-80. Two bladders were analyzed and their transfer functions approximated (assuming linearity) for both inflation and deflation. A theoretical versus actual time response comparison revealed the degree of linearity of bladder inflation and deflation. GRA

**N84-22173#** Army Aeromedical Research Lab., Fort Rucker, Ala.
**EFFECTS OF EXTENDED USE OF AN/PVS-5 NIGHT VISION GOGGLES ON HELICOPTER PILOTS' PERFORMANCE**
L. W. Stone and C. E. Duncan Jan. 1984 51 p
(DA Proj. 3E1-62777-A-879; DA Proj. 3E1-62773-A-819)
(AD-A138126; AD-E440224; USAARL-84-3) Avail: NTIS HC A04/MF A01 CSCL 05/5

The effects of extended use of AN/PVS-5 night vision goggles (NVG) were investigated by observing 10 NVG helicopter instructor pilots during two 6-hour missions. Each mission consisted of three 2-hour flights during which pilot control inputs and aircraft status variables were recorded in flight. Questionnaires were completed before the first mission and after the NVG mission. In order to examine for a carryover effect, subjects were flown in a crossover design in which half of the aviators flew NVG on the first mission, the other half on the second. Only the out-of-ground-effect hover showed a statistically significant carryover effect; that is, subjects who flew naked eye before NVG demonstrated a greater absolute difference in hover flight performance variability than those who flew naked eye after NVG flight. In the traffic pattern (final approach segment), there was a statistically significant difference between the visual conditions only. The postflight questionnaire responses revealed a concern over what was described as a lack of concentration and a decline of mental alertness. Some physiological stress reactions were reported. None of the three maneuvers analyzed revealed a significant effect on performance across flights. GRA

**N84-22174#** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
**HUMAN STRENGTH CAPABILITIES FOR THE OPERATION OF PARACHUTE RIPCORDS AND RISER RELEASES Technical Report, Oct. 1981 - Dec. 1982**
N. M. Aume, J. W. McDaniel, and T. Garver Oct. 1983 60 p
(AF Proj. 7184)
(AD-A138328; AFAMRL-TR-83-081) Avail: NTIS HC A04/MF A01 CSCL 05/5

Military Specification MIL-P-6645H permits a maximum pull of 27 pounds to activate a parachute ripcord. A test was conducted to evaluate this force. Two hundred eleven physically fit male and female subjects made maximum voluntary exertions on five different parachute ripcord handles with the left hand, the right hand, and with both hands. The applied isometric forces were recorded. Considerable differences in the recorded forces were found to be attributable to sex and to one versus two hand pulls; lesser differences were caused by variations in ripcord handle types and locations. When both hands were used, almost all male subjects could exceed the permitted 27-pound pull. Significant numbers of female subjects using either one or both hands, and male subjects using only one hand could not exceed 27 pounds of pull. As a result, the authors recommend that the currently specified 27 pound limit not be increased as has been proposed, and that teaching the two hand pull be continued. The same subjects also performed maximum voluntary exertions on two types of riser releases with the left and right hands. The type of riser release caused a significant difference in the force exerted. GRA

**N84-22175#** Canyon Research Group, Inc., Westlake Village, Calif.
**PART-TASK TRAINING OF TRACKING IN MANUAL CONTROL Final Report, 1 Sep. 1981 - 31 Aug. 1984**
D. C. Wightman and G. Lintern Sep. 1983 43 p
(Contract N61339-81-C-0105)
(AD-A138346; NAVTRAEQUIPC-81-C-0105-2) Avail: NTIS HC A03/MF A01 CSCL 05/9

Part-task trainers offer potential cost savings in flight training programs, in that relatively inexpensive devices might be used to train critical subskills prior to more comprehensive training in a simulator or in the criterion vehicle. Part-task methods are currently employed in many training programs with apparent success. However, there is no comprehensive statement of principles to guide users towards the best procedures or to help the maximize the effectiveness of procedures already being used. A review of the part-task training literature was undertaken to integrate the existing empirical data. The review was intended to identify the more promising principles and procedures for part-task training, and to provide a coherent guide to future research. Part-task training was defined as practice on some set of components of the whole task as a prelude to performance of the whole task. Part-task procedures are intended to improve learning efficiency and to reduce costs. Our review focused on the instruction of tracking skills for manual control. Transfer of training was emphasized and crucial features of the methodology and of means of assessing transfer were discussed. The part-task procedures of segmentation, fractionation and simplification were explained, and procedures for reintegrating parts into the whole task were summarized. GRA

**N84-22176#** Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.
**HUMAN FACTORS IN REMOTE CONTROL ENGINEERING DEVELOPMENT ACTIVITIES**
M. M. Clarke (Oak Ridge Associated Univs., Inc.), W. R. Hamel, and J. V. Draper (Oak Ridge Associated Univs., Inc.) 1983 19 p refs Presented at the ANS Ann. Meeting, Detroit, 14-18 Jun. 1983

(Contract W-7405-eng-26)
(DE84-003201; CONF-830609-64) Avail: NTIS HC A02/MF A01

Human factors engineering, which is an integral part of the advanced remote control development activities is described. It was shown that operators can perform a wide variety of tasks, some of which were not specifically designed for remote systems, with a dextrous electronic force reflecting servomanipulator and good television remote viewing capabilities. The data collected during mock up remote maintenance experiments at the RSDF were analyzed to provide guidelines for the design of human interfaces with an integrated advanced remote maintenance system which is under development. Guidelines are provided for task allocation between operators, remote viewing systems, and operator controls. DOE

**N84-22177#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Afd. Technische Menskunde.
**INVESTIGATION OF THE EFFECT OF THE VIEWING TARGET HEIGHT ON THE EYE HEIGHT OF SITTING VISUAL DISPLAY UNIT (VDU) OPERATORS**
J. Lombaers Jul. 1983 20 p refs In DUTCH; ENGLISH summary
(IZF-1983-9; TDCK-78189) Avail: NTIS HC A02/MF A01

The effect of the viewing target height on the eye height of sitting VDU operators was investigated. Twelve subjects performed a tracking task for 45 min. The viewing target was presented on a VDU placed at three different heights. The eye height was monitored by video cameras, and the recordings were analyzed with a video system. An increased viewing target height results in an increased mean eye height and a decreased standard deviation of the eye height. An influence of the viewing target height on the performance of the tracking task is not found. Author (ESA)

# 55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

**N84-22178*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**SETI SCIENCE WORKING GROUP REPORT**
Frank Drake (Cornell Univ.), John H. Wolfe (San Francisco Univ.), and Charles L. Seeger (San Francisco Univ.) Jan. 1984 119 p refs
(NASA-TP-2244; A-9326; NAS 1.60:2244) Avail: NTIS HC A07/MF A01 CSCL 05K

This report covers the initial activities and deliberations of a continuing working group asked to assist the SETI Program Office at NASA. Seven chapters present the group's consensus on objectives, strategies, and plans for instrumental R&D and for a microwave search for extraterrestrial in intelligence (SETI) projected for the end of this decade. Thirteen appendixes reflect the views of their individual authors. Included are discussions of the 8-million-channel spectrum analyzer architecture and the proof-of-concept device under development; signal detection, recognition, and identification on-line in the presence of noise and radio interference; the 1-10 GHz sky survey and the 1-3 GHz targeted search envisaged; and the mutual interests of SETI and radio astronomy. The report ends with a selective, annotated SETI reading list of pro and contra SETI publications. Author

# 59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

**N84-22179*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**COMPUTER-AIDED GEOMETRY MODELING**
John N. Shoosmith, comp. and Robert E. Fulton, comp. Washington Mar. 1984 387 p refs Symp. held in Hampton, Va., 20-22 Apr. 1983
(NASA-CP-2272; L-15618; NAS 1.55:2272) Avail: NTIS HC A17/MF A01 CSCL 12A

Techniques in computer-aided geometry modeling and their application are addressed. Mathematical modeling, solid geometry models, management of geometric data, development of geometry standards, and interactive and graphic procedures are discussed. The applications include aeronautical and aerospace structures design, fluid flow modeling, and gas turbine design. For individual titles, see N84-22180 through N84-22225.

**N84-22180*#** Drexel Univ., Philadelphia, Pa. Dept. of Mathematical Sciences.
**AN OPERATOR CALCULUS FOR SURFACE AND VOLUME MODELING** c61
William J. Gordon *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 1-6 refs (For primary document see N84-22179 12-59)
(Contract N00014-80-C-0176)
Avail: NTIS HC A17/MF A01 CSCL 09B

The mathematical techniques which form the foundation for most of the surface and volume modeling techniques used in practice are briefly described. An outline of what may be termed an operator calculus for the approximation and interpolation of functions of more than one independent variable is presented. By considering the linear operators associated with bivariate and multivariate interpolation/approximation schemes, it is shown how they can be compounded by operator multiplication and Boolean addition to obtain a distributive lattice of approximation operators. It is then demonstrated via specific examples how this operator calculus leads to practical techniques for sculptured surface and volume modeling. M.G.

**N84-22181*#** Structural Dynamics Research Corp., Milford, Ohio.
**A GEOMETRIC MODELER BASED ON A DUAL-GEOMETRY REPRESENTATION POLYHEDRA AND RATIONAL B-SPLINES** c61
Albert L. Klosterman *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 7-13 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

For speed and data base reasons, solid geometric modeling of large complex practical systems is usually approximated by a polyhedra representation. Precise parametric surface and implicit algebraic modelers are available but it is not yet practical to model the same level of system complexity with these precise modelers. In response to this contrast the GEOMOD geometric modeling system was built so that a polyhedra abstraction of the geometry would be available for interactive modeling without losing the precise definition of the geometry. Part of the reason that polyhedra modelers are effective is that all bounded surfaces can be represented in a single canonical format (i.e., sets of planar polygons). This permits a very simple and compact data structure. Nonuniform rational B-splines are currently the best representation to describe a very large class of geometry precisely with one canonical format. The specific capabilities of the modeler are described. M.G.

**N84-22182*#** Fairchild Republic Div., Farmingdale, N. Y.
**THE COMPUTATION OF ALL PLANE/SURFACE INTERSECTIONS FOR CAD/CAM APPLICATIONS** c61
David H. Hoitsma, Jr. and Martin Roche (Lundy Electronics and Systems, Inc.) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 15-18 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The problem of the computation and display of all intersections of a given plane with a rational bicubic surface patch for use on an interactive CAD/CAM system is examined. The general problem of calculating all intersections of a plane and a surface consisting of rational bicubic patches is reduced to the case of a single

generic patch by applying a rejection algorithm which excludes all patches that do not intersect the plane. For each pertinent patch the algorithm presented computed the intersection curves by locating an initial point on each curve, and computes successive points on the curve using a tolerance step equation. A single cubic equation solver is used to compute the initial curve points lying on the boundary of a surface patch, and the method of resultants as applied to curve theory is used to determine critical points which, in turn, are used to locate initial points that lie on intersection curves which are in the interior of the patch. Examples are given to illustrate the ability of this algorithm to produce all intersection curves. M.G.

**N84-22183*#** California Univ., Livermore. Lawrence Livermore Lab.

**USE OF SHAPE-PRESERVING INTERPOLATION METHODS IN SURFACE MODELING c61**

F. N. Fritsch (Drexel Univ.) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 19-24 refs (For primary document see N84-22179 12-59)
(Contract W-7405-eng-48)
Avail: NTIS HC A17/MF A01 CSCL 09B

In many large-scale scientific computations, it is necessary to use surface models based on information provided at only a finite number of points (rather than determined everywhere via an analytic formula). As an example, an equation of state (EOS) table may provide values of pressure as a function of temperature and density for a particular material. These values, while known quite accurately, are typically known only on a rectangular (but generally quite nonuniform) mesh in (T,d)-space. Thus interpolation methods are necessary to completely determine the EOS surface. The most primitive EOS interpolation scheme is bilinear interpolation. This has the advantages of depending only on local information, so that changes in data remote from a mesh element have no effect on the surface over the element, and of preserving shape information, such as monotonicity. Most scientific calculations, however, require greater smoothness. Standard higher-order interpolation schemes, such as Coons patches or bicubic splines, while providing the requisite smoothness, tend to produce surfaces that are not physically reasonable. This means that the interpolant may have bumps or wiggles that are not supported by the data. The mathematical quantification of ideas such as physically reasonable and visually pleasing is examined. M.G.

**N84-22184*#** Control Data Corp., Minneapolis, Minn.

**AN URNFUL OF BLINDING FUNCTIONS c64**

R. N. Goldman *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 25-35 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 12A

There is a fundamental connection between the mathematical theory of discrete probability distributions and the parametric curves and surfaces of computer-aided geometric design. It is no accident that the blending functions of Bezier curves and surfaces have an obvious probabilistic interpretation, nor is it a coincidence that the normalized uniform B-spline basis functions also model a simple stochastic process. The link between probability and geometry, and how to exploit simple probabilistic arguments to derive many of the classical geometric properties of the parametric curves and surfaces currently in vogue in computer-aided geometric design is discussed. This probabilistic approach is also used to introduce many new types of curves and surfaces, and it is demonstrated how probability theory can be used to simplify, unify, and generalize many well-known results. M.G.

**N84-22185*#** Cornell Univ., Ithaca, N.Y. Dept. of Structural Engineering.

**INTERSECTION OF PARAMETRIC SURFACES USING LOOKUP TABLES c61**

Samir L. Hanna, John F. Abel, and Donald P. Greenberg *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 37-49 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

When primitive structures in the form of parametric surfaces are combined and modified interactively to form complex intersecting surfaces, it becomes important to find the curves of intersection. One must distinguish between finding the shape of the intersection curve, which may only be useful for display purposes, and finding an accurate mathematical representation of the curve, which is important for any meaningful geometric modeling, analysis, design, or manufacturing involving the intersection. The intersection curve between two or more parametric surfaces is important in a variety of computer-aided design and manufacture areas. A few examples are shape design, analysis of groins, design of fillets, and computation of numerically controlled tooling paths. The algorithm presented here provides a mathematical representation of the intersection curve to a specified accuracy. It also provides the database that can simplify operations such as hidden-surface removal, surface rendering, profile identification, and interference or clearance computations. M.G.

**N84-22186*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SURFACE GRID GENERATION FOR WING-FUSELAGE BODIES c64**

R. E. Smith, R. A. Kudlinski, and J. I. Pitts *In its* Computer-Aided Geometry Modeling Mar. 1984 p 51-60 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 12A

In the application of finite-difference methods to obtain numerical solutions of viscous compressible fluid flow about wing-fuselage bodies, it is advantageous to transform the governing equations to an idealized boundary-fitted coordinate system. The advantages are reduced computational complexity and added accuracy in the application of boundary conditions. The solution process requires that a grid be superimposed on the physical solution domain which corresponds to a uniform grid on a rectangular computational domain (uniform rectangular parallelepiped). Grid generation is the determination of a one to one relationship between grid points in the physical domain and grid points in the computational domain. A technique for computing wing-fuselage surface grids using the Harris geometry and software for smooth-surface representation is described. Grid spacing control concepts which govern the relationship between the wing-fuselage surface and the computational grid are also presented. M.G.

**N84-22187*#** Rochester Univ., N. Y. Office of Production Automation Project.

**SOLID MODELLING: HISTORY, STATUS AND CURRENT RESEARCH DIRECTIONS c61**

Herbert B. Voelcker *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 61-79 ref Sponsored in part by NSF (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

Research aimed at producing new generations of solid modelling systems, and at extending the applications of solid modelling, is in progress and will be discussed briefly in this paper. Three major bodies of work are emerging: solid-modelling extensions, applications in design, and applications in production. Each area contains many parallel streams of work, with considerable cross-flow of concepts and techniques between the streams and areas. Author

**N84-22188*#** Sandia Labs., Albuquerque, N. Mex.

**SOLID MODELLING IN THE DEPARTMENT OF ENERGY c61**

D. R. Peterson *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 81-86 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

Three solid modellers (SMs) are evaluated in this study. The findings and opinions about their merits and deficiencies are discussed. B.W.

**N84-22189*#** Texas Univ., Austin.
**VOLUMETRIC REPRESENTATION FOR OBJECT MODEL ACQUISITION** **c61**
W. N. Martin (Virginia Univ.), B. Gil, and J. K. Aggarwal *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 87-93 refs (For primary document see N84-22179 12-59)
(Grant AF-AFOSR-0064-82)
Avail: NTIS HC A17/MF A01 CSCL 09B

This paper describes a volumetric representation that has been specified for use in a system that derives object models from a sequence of images with viewpoint specifications. This volumetric representation is an enumerative structure referred to here as a volume segment representation. The model acquisition system was designed to form an initial object approximation, then refine that approximation as subsequent information is obtained. The refinement process requires a readily modifiable object representation, while the overall goal of the system demands a representation descriptive of surface detail. The volume segment structure provides both of those capabilities. B.W.

**N84-22190*#** Virginia Univ., Charlottesville. Dept. of Applied Mathematics.
**THE REPRESENTATION OF MANIPULABLE SOLID OBJECTS IN A RELATIONAL DATABASE** **c61**
Dennis Bahler *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 95-100 refs (For primary document see N84-22179 12-59)
(Contract NAG5-28209)
Avail: NTIS HC A17/MF A01 CSCL 09B

This project is concerned with the interface between database management and solid geometric modeling. The desirability of integrating computer-aided design, manufacture, testing, and management into a coherent system is by now well recognized. One proposed configuration for such a system uses a relational database management system as the central focus; the various other functions are linked through their use of a common data repesentation in the data manager, rather than communicating pairwise to integrate a geometric modeling capability with a generic relational data managemet system in such a way that well-formed questions can be posed and answered about the performance of the system as a whole. One necessary feature of any such system is simplification for purposes of anaysis; this and system performance considerations meant that a paramount goal therefore was that of unity and simplicity of the data structures used. B.W.

**N84-22191*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INTERACTIVE GEOMETRY MODELING OF SPACE STATION CONCEPTUAL DESIGNS Abstract Only** **c61**
Dariene D. DeRyder, Melvin J. Ferebee, Jr., and Mark L. McMillin *In its* Computer-Aided Geometry Modeling Mar. 1984 p 101-102 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

With the advent of a serious interest in the design and implementaton of a low-Earth orbit, manned space station, the need has arisen to rapidly synthesize, characterize, and analyze many conceptual designs. Because the manual generation and analysis of a mathematical design model could consume many man-months, an interactive modeling and analysis capability is sought. This poster session will demonstrate the activities and current capabilities at NASA LaRC that could support the modeling analysis of space station conceptual designs. Author

**N84-22192*#** McDonnell-Douglas Automation Co., St. Louis, Mo.
**TRANSLATORS BETWEEN CADD AND SECTION 5 OF THE ANSI Y14.26M STANDARD** **c61**
R. F. Emnett, W. B. Gruttke, E. G. Houghton, and J. E. Oakes *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 103-117 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The American National Standard, Engineering Drawing and Related Documentation Practices, Digital Representation for Communication of Product Definition Data (ANSI Y14.26M-1981) comprises an introduction, three sections corresponding to IGES (Initial Graphics Exchange Specification) Version 1.0, and Section 5, a constructive, relational, language-based representation for geometric and topological entities. This presentation discusses the design and development of two-way translators between Section 5 (herein, ANSI5) and CADD (Computer-Aided Design Drafting). Author

**N84-22193*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**AN INTERSECTION ALGORITHM FOR MOVING PARTS** **c61**
D. M. Esterling (George Washington Univ.) and J. VanRosendale *In its* Computer-Aided Geometry Modeling Mar. 1984 p 119-123 refs (For primary document see N84-22179 12-59)
(Contracts NCC1-36; NAS1-15810; NAS1-16394)
Avail: NTIS HC A17/MF A01 CSCL 09B

The problem of deciding whether moving mechanical parts will collide during motion arises frequently in computer-aided design of machinery and in robotics. In machinery design, the problem becomes acute when there are various complex curved mechanical parts that will follow planned trajectories. There is a need to know at an early stage in the design process whether there will be collisions between parts necessitating changes in part shapes, trajectories, or in the overall design. This paper describes a collision detection algorithm that is guaranteed to detect a collision if one will occur, and it also computes the earliest point of contact. B.W.

**N84-22194*#** Ecole Polytechnique, Montreal (Quebec).
**GENERATION OF SURFACE-FITTED COORDINATE GRIDS** **c61**
A. Garon and R. Camarero *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 125-138 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

An accurate numerical solution of the Navier-Stokes equations is strongly dependent on the description of the flow geometry. In the past, rectangular grids led to an ill description of curved boundaries and consequently hindered finite-difference solutions. Now, it is accepted that body-fitted coordinate systems give a much better description of complex flow geometries. The generation of body-fitted curvilinear coordinate grids in two dimensions by the solution of a nonlinear system of elliptic equations has been proposed Thompson. It has been extended to three dimensions and applied in practical configurations. B.W.

**N84-22195*#** Computer Sciences Corp., Hampton, Va.
**APPLICATION AND ENHANCEMENTS OF MOVIE.BYU** **c61**
Raymond L. Gates and William H. VonOfenheim *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 135-138 ref (For primary document see N84-22179 12-59)
(Contract NAS1-16078)
Avail: NTIS HC A17/MF A01 CSCL 09B

MOVIE.BYU (MOVIE.BRIGHAM YOUNG UNIVERSITY) is a system of programs for the display and manipulation of data representing mathematical, architectural, and topological models in which the geometry may be described in terms of panel (n-sided polygons) and solid elements or contour lines. The MOVIE.BYU system has been used in a series of applications of LaRC. One application has been the display, creation, and manipulation of finite element models in aeronautic/aerospace research. These models have been displayed on both vector and color raster devices, and the user has the option to modify color and shading parameters on these color raster devices. Another application involves the display of scalar functions (temperature, pressure, etc.) over the surface of a given model. This capability gives the researcher added flexibility in the analysis of the model and its accompanying data. Limited animation (frame-by-frame creation) has been another application of MOVIE.BYU in the modeling of kinematic processes in antenna structures. B.W.

**N84-22196*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**DESKTOP COMPUTER GRAPHICS FOR RMS/PAYLOAD HANDLING FLIGHT DESIGN** **c61**
D. J. Homan *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 139-143 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

A computer program, the Multi-Adaptive Drawings, Renderings and Similitudes (MADRAS) program, is discussed. The modeling program, written for a desktop computer system (the Hewlett-Packard 9845/C), is written in BASIC and uses modular construction of objects while generating both wire-frame and hidden-line drawings from any viewpoint. The dimensions and placement of objects are user definable. Once the hidden-line calculations are made for a particular viewpoint, the viewpoint may be rotated in pan, tilt, and roll without further hidden-line calculations. The use and results of this program are discussed. R.J.F.

**N84-22197*#** Princeton Univ., N. J.
**AUTOMATIC GENERATION OF 3-D ENVELOPES** **c61**
James Leavitt and Walter Mesdcher (Transportation Systems Center) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 145-149 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The object of this research is the automatic generation of three-dimensional envelopes. Using the computer, an envelope surface for any object moved along any path may be developed. In this way, the geometry of physical objects and regions may be modeled. The FORTRAN computer language is used, and resulting envelopes are plotted pictorially. Author

**N84-22198*#** Drexel Univ., Philadelphia, Pa. Analysis and Testing Group.
**ESCHER: AN INTERACTIVE MESH-GENERATING EDITOR FOR PREPARING FINITE-ELEMENT INPUT** **c61**
W. R. Oakes, Jr. *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 151-153 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

ESCHER is an interactive mesh generation and editing program designed to help the user create a finite-element mesh, create additional input for finite-element analysis, including initial conditions, boundary conditions, and slidelines, and generate a NEUTRAL FILE that can be postprocessed for input into several finite-element codes, including ADINA, ADINAT, DYNA, NIKE, TSAAS, and ABUQUS. Two important ESCHER capabilities, interactive geometry creation and mesh archival storge are described in detail. Also described is the interactive command language and the use of interactive graphics. The archival storage and restart file is a modular, entity-based mesh data file. Modules of this file correspond to separate editing modes in the mesh editor, with data definition syntax preserved between the interactive commands and the archival storage file. Because ESCHER was expected to be highly interactive, extensive user documentation was provided in the form of an interactive HELP package. R.J.F.

**N84-22199*#** Computer Sciences Corp., Hampton, Va.
**THE SOLID MODEL GEOMETRY GENERATOR (SMGG)** **c61**
K. H. Jones, D. P. Randall, R. L. Gates, and W. H. VonOfenheim *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 155-164 (For primary document see N84-22179 12-59)
(Contract NAS1-16078)
Avail: NTIS HC A17/MF A01 CSCL 09B

The Solid Model Geometry Generator (SMGG) system provides the capacity to model complex solid objects through the composition of primitive parts. The parts are specified through input of dimension and orientation parameters. The parts may later be edited, the model may be displayed (through a variety of display options), and the resulting geometry formatted for subsequent analysis. The SMGG system was originally constructed for use in the preliminary stages of space station and other spacecraft design. Because the system models a design through the use of basic shapes common to many solid objects and provides limited capabilities for producing irregularly shaped parts, it can be used for a variety of applications. Currently, seven primitive parts may be specified and produced through SMGG. These include boxes, spheres, cones, paraboloids, tori, and translationally or rotationally swept parts. Each part may be specified by the user through input of basic part dimensions and a local orientation. For example, a box is specified by its length, width, height and orientation in space (rotation, translation, and scaling). R.J.F.

**N84-22200*#** Polhemus Navigation Sciences, Inc., Essex Junction, VT.
**THE 3SPACE DIGITIZER: A NEW INPUT DEVICE FOR SOLID GEOMETRY MODELING** **c61**
Jack Scully *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 165-168 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The 3SPACE Digitizer is a derivation of SPASYN, which is a patented magnetic transducing system offering an accurate method of calculating the location of one object relative to another. SPASYN uses low-frequency magnetic fields to measure both the position and orientation of its sensor relative to its transmitter. The 3SPACE Digitizer unit consists of a system's electronics unit, a model table, a stylus, and a keypad. In operation, the 3SPACE Digitizer determines the X, Y, Z coordinates of any point located on a low-conductive, three-dimensional model. This data, along with the orientation of the Digitizer's stylus, is immediately available for transmission to a host computer or graphics terminal. Digitization is effected by touching the point to be measured with the tip of a handheld stylus. The 3SPACE Digitizer presents new opportunities for interacting with computers in a large number of engineering and scientific applications. Developed from proven military technology, the 3SPACE Digitizer significantly simplifies three-dimensional digitization and overcomes many of the problems that once plagued such procedures. Its ability to digitize solid objects makes it a valuable new tool for computer-aided design and manufacturing. R.J.F.

**N84-22201*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INTERACTIVE MODELING USING THE PATRAN-G PROGRAM** **c61**
Winifred A. Stalnaker *In its* Computer-Aided Geometry Modeling Mar. 1984 p 169-171 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

PATRAN-G is an interactive finite element generating and graphics display program. The program is currently executable on the VAX or PRIME computers and is compatible with 19 commercially available graphics terminals. The PATRAN program can be used in two modes: generation of a finite element model, or postprocessing of output data from a finite element analysis program. The finite element generating mode is divided into two phases. Phase I is the geometry construction. During this phase, the geometric boundaries of the model are defined and the material properties are input. Mirror imaging, translation and scaling of lines, surfaces, and volumes, and rotation of regions permit the geometry to be described efficiently. Points may be defined in alternate rectangular, cylindrical, or spherical coordinate systems. Also, PATRAN-G can calculate the intersection of lines or surfaces. This capability allows a user to easily model, for example, the intersection of a cylinder which cuts through a sphere at an angle. Once the geometry of the model has been described in terms of points, lines, surfaces, and volumes. Phase II is used to generate the computer finite element model. R.J.F.

**N84-22202*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INTERACTIVE GRAPHICS FOR QUICK-GEOMETRY MODELING** **c61**

James C. Townsend *In its* Computer-Aided Geometry Modeling Mar. 1984 p 173-180 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The QUICK-geometry system is a method for defining configuration shapes in completely analytical form. It was developed for use when the analytical definition of aircraft geometry is advantageous or necessary for the solution of the flow around it. While the QUICK-geometry system provides a convenient and flexible method for generating configurations with completely analytical definitions, experience showed that it can be difficult to match a previously defined configuration with a QUICK-geometry definition. Therefore, the National Aeronautics and Space Administration (NASA) and other users developed computer programs that aid in the generation of QUICK inputs. A NASA-developed set of such programs which recently were upgraded extensively to improve its usability and portability are described. R.J.F.

**N84-22203*#** Technology Development Corp., Santa Clara, Calif.
**DATA ENGINEERING SYSTEMS: COMPUTERIZED MODELING AND DATA BANK CAPABILITIES FOR ENGINEERING ANALYSIS c82**
H. Kopp, R. Trettau, and B. Zolotar *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 181-184 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 05B

The Data Engineering System (DES) is a computer-based system that organizes technical data and provides automated mechanisms for storage, retrieval, and engineering analysis. The DES combines the benefits of a structured data base system with automated links to large-scale analysis codes. While the DES provides the user with many of the capabilities of a computer-aided design (CAD) system, the systems are actually quite different in several respects. A typical CAD system emphasizes interactive graphics capabilities and organizes data in a manner that optimizes these graphics. On the other hand, the DES is a computer-aided engineering system intended for the engineer who must operationally understand an existing or planned design or who desires to carry out additional technical analysis based on a particular design. The DES emphasizes data retrieval in a form that not only provides the engineer access to search and display the data but also links the data automatically with the computer analysis codes. R.J.F.

**N84-22204*#** Utah Univ., Salt Lake City. Dept. of Computer Science.
**SOME MATHEMATICAL TOOLS FOR A MODELLER'S WORKBENCH c64**
Elaine Cohen *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 185-190 refs (For primary document see N84-22179 12-59)
(Contracts DAAG29-81-K-0111; DAAG29-82-K-0176; N00014-82-K-0351; Grants NSF MCS-82-03692; NSF MCS-81-21750)
Avail: NTIS HC A17/MF A01 CSCL 12A

The development of a mathematical software tools in workbench environment to model related objects more straightforward is outlined. A computer model from informal drawings and a plastic model of a helicopter is discussed. Lofting was the predominant, characteristic modelling technique. Ships and airplane designs use lofting as a technique because they have defined surfaces, (hulls and fuselages) from vertical station cuts perpendicular to the vertical center plane defining the major axis of reflective symmetry. A turbine blade from a jet engine was modelled in this way. The aerodynamic portion and the root comes from different paradigms. The union of these two parts into a coherent model is shown.
E.A.K.

**N84-22205*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**THE TRIANGLE COMPARE METHOD OF HIDDEN-LINE ELIMINATION c61**
Charles R. Price *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 191-198 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

An original algorithm which solves the classical computer graphics problem of eliminating those lines that should not be visible in a wire-frame model representation of a solid figure is presented. The basis of this Triangle Compare algorithm is that any polygon, regardless of its complexity, can be constructed from a set of triangles. In the Triangle Compare algorithm, once the triangles defining the figure are defined, they are ordered based on the nearness of each triangle to the viewer and stored in a linked list. The nearest triangle are compared to all succeeding triangles. The remaining parts of triangles are synthesized into other triangles and are added in order to the linked list. Subsequent reference triangles are provided by a traversal of the linked list. After the entire list is traversed and each triangle used as a reference, the resulting list is used for a final rendering with hidden lines removed via calligraphic MOVE and DRAW commands.
E.A.K.

**N84-22206*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**COMPUTER GRAPHICS IN AERODYNAMIC ANALYSIS c61**
J. V. Cozzolongo *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 199-207 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The use of computer graphics and its application to aerodynamic analyses on a routine basis is outlined. The mathematical modelling of the aircraft geometries and the shading technique implemented are discussed. Examples of computer graphics used to display aerodynamic flow field data and aircraft geometries are shown. A future need in computer graphics for aerodynamic analyses is addressed. E.A.K.

**N84-22207*#** Rensselaer Polytechnic Inst., Troy, N. Y. Center for Interactive Computer Graphics.
**INTERACTIVE GRAPHICS FOR GEOMETRY MODELING c61**
Michael J. Wozny *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 209-213 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

An interactive vector capability to create geometry and a raster color shaded rendering capability to sample and verify interim geometric design steps through color snapshots is described, The development is outlined of the underlying methodology which facilitates computer aided engineering and design. At present, raster systems cannot match the interactivity and line-drawing capability of refresh vector systems. Consequently, an intermediate step in mechanical design is used to create objects interactively on the vector display and then scan convert the wireframe model to render it as a color shaded object on a raster display. Several algorithms are presented for rendering such objects. Superquadric solid primitive extend the class of primitives normally used in solid modelers. E.A.K.

**N84-22208*#** Cornell Univ., Ithaca, N.Y. Dept. of Structural Engineering.
**INTERACTIVE COMPUTER GRAPHIC SURFACE MODELING OF THREE-DIMENSIONAL SOLID DOMAINS FOR BOUNDARY ELEMENT ANALYSIS c61**
Renato Perucchio and Anthony R. Ingraffea *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 215-222 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The establishment of the boundary element method (BEM) as a valid tool for solving problems in structural mechanics and in other fields of applied physics is discussed. The development of an integrated interactive computer graphic system for the application of the BEM to three dimensional problems in elastostatics is described. The integration of interactive computer graphic techniques and the BEM takes place at the preprocessing and postprocessing stages of the analysis process, when, respectively, the data base is generated and the results are interpreted. The

interactive computer graphic modeling techniques used for generating and discretizing the boundary surfaces of a solid domain are outlined. E.A.K.

**N84-22209*#** Washington Univ., Seattle. Dept. of Mechanical Engineering.
**INTERACTIVE WIRE-FRAME SHIP HULLFORM GENERATION AND DISPLAY** **c61**
D. E. Calkins, J. L. Garbini, and J. Ishimaru *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 223-234 ref (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

An interactive automated procedure to generate a wire frame graphic image of a ship hullform, which uses a digitizing tablet in conjunction with the hullform lines drawing, was developed. The geometric image created is displayed on an Evans & Sutherland PS-300 graphics terminal for real time interactive viewing or is output as hard copy on an inexpensive dot matrix printer. E.A.K.

**N84-22210*#** Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
**AN INTERACTIVE MODELING PROGRAM FOR THE GENERATION OF PLANAR POLYGONS FOR BOUNDARY TYPE SOLIDS REPRESENTATIONS OF WIRE FRAME MODELS** **c61**
Tulga Ozsoy and John B. Ochs *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 235-240 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The development of a general link between three dimensional wire frame models and rigid solid models is discussed. An interactive computer graphics program was developed to serve as a front end to an algorithm (COSMIC Program No. ARC-11446) which offers a general solution to the hidden line problem where the input data is either line segments of n-sided planar polygons of the most general type with internal boundaries. The program provides a general interface to CAD/CAM data bases and is implemented for models created on the Unigraphics VAX 11/780-based CAD/CAM systems with the display software written for DEC's VS11 color graphics devices. E.A.K.

**N84-22211*#** Boeing Computer Services, Inc., Seattle, Wash.
**MANAGING GEOMETRIC INFORMATION WITH A DATA BASE MANAGEMENT SYSTEM** **c60**
R. P. Dube *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 241-254 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The strategies for managing computer based geometry are described. The computer model of geometry is the basis for communication, manipulation, and analysis of shape information. The research on integrated programs for aerospace-vehicle design (IPAD) focuses on the use of data base management system (DBMS) technology to manage engineering/manufacturing data. The objectives of IPAD is to develop a computer based engineering complex which automates the storage, management, protection, and retrieval of engineering data. In particular, this facility must manage geometry information as well as associated data. The approach taken on the IPAD project to achieve this objective is discussed. Geometry management in current systems and the approach taken in the early IPAD prototypes are examined. E.A.K.

**N84-22212*#** Control Data Corp., Bloomington, Minn. Data Management Technology Center.
**CAD/CAM DATA MANAGEMENT** **c82**
Olin H. Bray *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 255-260 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 05B

The role of data base management in CAD/CAM, particularly for geometric data is described. First, long term and short term objectives for CAD/CAM data management are identified. Second, the benefits of the data base management approach are explained. Third, some of the additional work needed in the data base area is discussed. Author

**N84-22213*#** Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
**THE VIRTUAL FRONT END: TOWARDS BETTER MANAGEMENT OF SOLID GEOMETRIC DATA** **c61**
William W. Charlesworth and Michael J. Bailey *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 261-267 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

Throughout the last decade, Computer Aided Design was seen as a Great Promise. Much was accomplished, but that pales in comparison with what was promised. Ultimate achievement has always seemed just a step away. During the era of the early turnkey system, the one step was limited by modeling geometry through a wire frame. Besides being cumbersome to deal with in three dimensions, it was continually shown that a wire frame is ambiguous. This made the modeling of geometry for engineering purposes even more frustrating. The fundamentals of computer aided engineering design rest on the ability to do various analyses. Presently, solid modeling is taking the mechanical engineering CAD world by storm. There are no fewer than 20 solid modeling packages around the world, and more appearing with each vendor show. The question of integration, that is, the combination of elements of the CAD process into unified and easily usable design tools still exists. Author

**N84-22214*#** Tokyo Univ. (Japan). Dept. of Information Science.
**AN ENHANCED OCT-TREE DATA STRUCTURE AND OPERATIONS FOR SOLID MODELING** **c61**
K. Fujimura, H. Toriya (Ricoh Co., Ltd.), K. Yamaguchi, and T. L. Kunii *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 269-277 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

Oct-trees are enhanced to increase the processing efficiency of geometric operations for interactive CAD use. Further enhancement is made to combine them with surface models for more precise boundary specification as needed by tool path generation in CAM applications. Author

**N84-22215*#** National Bureau of Standards, Washington, D.C.
**IGES, A KEY INTERFACE SPECIFICATION FOR CAD/CAM SYSTEMS INTEGRATION** **c61**
Bradford M. Smith and Joan Wellington *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 279-288 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The Initial Graphics Exchange Specification (IGES) program has focused the efforts of 52 companies on the development and documentation of a means of graphics data base exchange among present day CAD/CAM systems. The project's brief history has seen the evolution of the Specification into preliminary industrial usage marked by public demonstrations of vendor capability, mandatory requests in procurement actions, and a formalization into an American National Standard in September 1981. Recent events have demonstrated intersystem data exchange among seven vendor systems with a total of 30 vendors committing to offer IGES capability. A full range of documentation supports the IGES project and the recently approved IGES Version 2.0 of the Specification. Author

**N84-22216*#** McDonnell-Douglas Automation Co., St. Louis, Mo.
**REFLECTIONS ON REPRESENTING NON-GEOMETRIC DATA** **c61**
R. F. Emnett and H. H. Shu (McDonnell Douglas Astronautics Co.) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 289-302 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The American National Standard Y14.26M-1981 on Digital

Representation for Communication of Product Definition Data includes an introduction, three sections corresponding to IGES (Initial Graphics Exchange Specification) Version 1.0, and Section 5, which is a constructive, relational, language based representation for geometric and topological entities. Author

**N84-22217*#** McDonnell-Douglas Automation Co., St. Louis, Mo.
**MODELING CONCEPTS FOR COMMUNICATION OF GEOMETRIC SHAPE DATA** **c61**
M. F. Collins (Control Data Corp.), R. F. Emnett, R. L. Magedson (Boeing Commercial Airplane Co.), and H. H. Shu (McDonnell Douglas Astronautics Co.) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 303-318 ref (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

ANSI5, an abbreviation for Section 5 of the American National Standard under Engineering Drawing and Related Documentation Practices (Committee Y14) on Digital Representation for Communication of Product Definition Data (ANSI Y14.26M-1981), allows encoding of a broad range of geometric shapes to be communicated through digital channels. A brief review of its underlying concepts is presented. The intent of ANSI5 is to devise a unified set of concise language formats for transmission of data pertaining to five types of geometric entities in Euclidean 3 space (E(3)). These are regarded as point like, curve like, surface like, solid like, and a combination of these types. For the first four types, ANSI5 makes a distinction between the geometry and topology. Geometry is a description of the spatial occupancy of the entity, and topology discusses the interconnectedness of the entity's boundary components. Author

**N84-22218*#** Utah Univ., Salt Lake City.
**COMPUTER-AIDED SURFACE REPRESENTATION AND DESIGN Abstract Only** **c61**
Robert E. Barnhill *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 319 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

New methods for representing and approximating three and four dimensional surfaces were created. These schemes are the core of our forthcoming Surface Software Package. Surfaces are understood adequately only through the use of dynamic computer graphics; therefore, graphics capability is also included. The numerous applications of surface methods include modeling physical phenomena (e.g., combustion) and designing objects (e.g., airplanes and cars). Author

**N84-22219*#** Avco Lycoming Div., Stratford, Conn.
**PRESENT CAPABILITIES AND FUTURE REQUIREMENTS FOR COMPUTER-AIDED GEOMETRIC MODELING IN THE DESIGN AND MANUFACTURE OF GAS TURBINE** **c61**
E. Caille, M. Propen, and A. Hoffman *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 321-325 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

Gas turbine engine design requires the ability to rapidly develop complex structures which are subject to severe thermal and mechanical operating loads. As in all facets of the aerospace industry, engine designs are constantly driving towards increased performance, higher temperatures, higher speeds, and lower weight. The ability to address such requirements in a relatively short time frame has resulted in a major thrust towards integrated design/analysis/manufacturing systems. These computer driven graphics systems represent a unique challenge, with major payback opportunities if properly conceived, implemented, and applied. Author

**N84-22220*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**A COLLECTION OF PROCEDURES FOR DEFINING AIRPLANE SURFACES FOR INPUT TO PANAIR** **c61**
Ralph L. Carmichael *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 327-346 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

In order to produce networks for PANAIR, the user is greatly aided by a geometry package that will produce networks in the correct format. Although the best solution to this problem is the use of a suitably modified computer-aided design system, a collection of programs has been written to allow the user with a small-scale computer to generate networks that represent configurations of considerable generality. This repertoire of programs enables users of PANAIR to create networks with a minimum of effort and should increase the overall usefulness of the PANAIR program. Author

**N84-22221*#** Boeing Commercial Airplane Co., Seattle, Wash.
**THE COMPUTATION OF MESH CONFIGURATIONS FOR THREE-DIMENSIONAL FLOW ANALYSIS** **c61**
S. G. Gibson *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 347-358 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

A geometry modeling method was developed to define three-dimensional mesh configurations, which were expressed by the set of surface intersections with a coordinate mesh. These configurations define bodies for transonic potential-flow computation in simple physical coordinates. Various configurations were prepared for 3-D potential flow analysis, including many bare inlet models in cylindrical coordinates. Trimmed surface models were used to prepare nacelle installation configurations. A variety of ducts and mixers were represented. Analytically defined mesh/surface intersections were compared with similar data obtained from the corresponding surface model. Parameters for an analytic surface definition from mesh-surface intersections obtained from a model of the surface were produced. In both studies the modeling accuracy was shown to be compatible with the flow analysis requirements. This technique fulfills the requirements of the associated three-dimensional potential-flow analysis. It preserves the flow analysis method's superior flexibility for adapting to unusual geometries. The geometry modeling technique is supported by a sufficient set of tools for effective use by general users, and sufficient accuracy was demonstrated. Author

**N84-22222*#** Lockheed-Georgia Co., Marietta.
**EVALUATION OF 3-D GRAPHICS SOFTWARE: A CASE STUDY** **c61**
M. E. Lores, S. H. Chasen, and J. M. Garner *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 359-376 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

An efficient 3-D geometry graphics software package which is suitable for advanced design studies was developed. The advanced design system is called GRADE--Graphics for Advanced Design. Efficiency and ease of use are gained by sacrificing flexibility in surface representation. The immediate options were either to continue development of GRADE or to acquire a commercially available system which would replace or complement GRADE. Test cases which would reveal the ability of each system to satisfy the requirements were developed. A scoring method which adequately captured the relative capabilities of the three systems was presented. While more complex multi-attribute decision methods could be used, the selected method provides all the needed information without being so complex that it is difficult to understand. If the value factors are modestly perturbed, system Z is a clear winner based on its overall capabilities. System Z is superior in two vital areas: surfacing and ease of interface with application programs. M.A.C.

**N84-22223*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**USING A COMMERCIAL CAD SYSTEM FOR SIMULTANEOUS INPUT TO THEORETICAL AERODYNAMIC PROGRAMS AND WIND-TUNNEL MODEL CONSTRUCTION** **c61**
Francis Enomoto and Paul Keller *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 377-387

(For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

The Computer Aided Design (CAD) system's common geometry database was used to generate input for theoretical programs and numerically controlled (NC) tool paths for wind tunnel part fabrication. This eliminates the duplication of work in generating separate geometry databases for each type of analysis. Another advantage is that it reduces the uncertainty due to geometric differences when comparing theoretical aerodynamic data with wind tunnel data. The system was adapted to aerodynamic research by developing programs written in Design Analysis Language (DAL). These programs reduced the amount of time required to construct complex geometries and to generate input for theoretical programs. Certain shortcomings of the Design, Drafting, and Manufacturing (DDM) software limited the effectiveness of these programs and some of the Calma NC software. The complexity of aircraft configurations suggests that more types of surface and curve geometry should be added to the system. Some of these shortcomings may be eliminated as improved versions of DDM are made available. M.A.C

**N84-22224*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**MATHEMATICAL SYNTHESIZATION OF COMPLEX STRUCTURES c64**
L. Bernard Garrett *In its* Computer-Aided Geometry Modeling Mar. 1984 p 389-398 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 12A

A mathematical synthesization approach for rapidly modeling and analyzing complex structures comprised of hundreds or thousands of repeating individual structural members, interconnecting hardware, and other components was described. The techniques are applicable to any structure with repeating structural members. The capabilities are embodied within the Interactive Design and Evaluation of Advanced Spacecraft (IDEAS) computer-aided design system. IDEAS has a full range of integrated spacecraft modeling, design, analysis, performance, and cost estimating capabilities which include about 40 technical program and executive, data base, and file management systems. With IDEAS, a single user at an interactive terminal can create, design, analyze, and conduct parametric studies of Earth orbiting spacecraft in a timely, cost-efficient manner. The system is particularly useful in the conceptual design phases of advanced space missions when a multiplicity of concepts must be evaluated. The IDEAS interactive finite-element modeling capabilities are discussed. The mathematical synthesization programs were structured not only to provide a detailed finite-element model of the structure but also to automatically perform the many auxiliary computations needed to analyze the spacecraft in its orbital operational environment. M.A.C.

**N84-22225*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**GEOMETRIC MODELING OF LARGE SPACE ANTENNA DEPLOYMENT Abstract Only c61**
John Nazemetz (Oklahoma State Univ.), Karen Sage (Kentron International), Ray L. Gates (Computer Services Corp.), and Dariene D. DeRyder *In its* Computer-Aided Geometry Modeling Mar. 1984 p 399 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

A dynamic visualization of large antenna deployment was created to be used as a precursor to further analysis of the structure as it is being deployed. The configuration chosen for this investigation was a box-truss structure consisting of a large reflector 60 meters wide by 120 meters long with a 120-meter mast. The entire space structure is folded and compressed into a container 17.8 meters long by 3.75 meters in diameter for transportation to orbit by the Space Transportation System (STS). A geometric model of this structure was created using an interactive solid modeling package. The building blocks of the structure are boxes and cylinders which are put together to form elements connected by joints and hinges. The elements, joints, and hinges make up the box-truss structure. The geometric model was then passed to the MOVIE.BYU software package. The 'utility' module of this program was used to manipulate the elements of the structure to represent 13 different stages of deployment. The 'animate' command was then used to create a smooth sequence between stages. Each step in the sequence was recorded on magnetic tape and a short movie was produced. M.A.C.

**N84-22226*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**CUMULATIVE REPORTS AND PUBLICATIONS THROUGH 31 DECEMBER 1983 Final Report**
31 Dec. 1983 32 p refs
(Contracts NAS1-17070; NAS1-17130)
(NASA-CR-172326; NAS 1.26:172326) Avail: NTIS HC A03/MF A01 CSCL 12A

All reports for the calendar years 1975 through December 1983 are listed by author. Since ICASE reports are intended to be preprints of articles for journals and conference proceedings, the published reference is included when available. Thirteen older journal and conference proceedings references are included as well as five additional reports by ICASE personnel. Major categories of research covered include: (1) numerical methods, with particular emphasis on the development and analysis of basic algorithms; (2) computational problems in engineering and the physical sciences, particularly fluid dynamics, acoustics, structural analysis, and chemistry; and (3) computer systems and software, especially vector and parallel computers, microcomputers, and data management. A.R.H.

**N84-22227*#** Boeing Computer Services, Inc., Seattle, Wash. Energy Technology Applications Div.
**REVIEW AND VERIFICATION OF CARE 3 MATHEMATICAL MODEL AND CODE Interim Report**
D. M. Rose, R. E. Altschul, J. W. Manke, and D. L. Nelson Apr. 1983 183 p refs
(Contract NAS1-16900)
(NASA-CR-166096; NAS 1.26:166096; BCS-40389) Avail: NTIS HC A09/MF A01 CSCL 12A

The CARE-III mathematical model and code verification performed by Boeing Computer Services were documented. The mathematical model was verified for permanent and intermittent faults. The transient fault model was not addressed. The code verification was performed on CARE-III, Version 3. A CARE III Version 4, which corrects deficiencies identified in Version 3, is being developed. Author

# 60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

**N84-22228*#** Virginia Univ., Charlottesville. School of Engineering and Applied Science.
**THE IMPLEMENTATION AND USE OF ADA ON DISTRIBUTED SYSTEMS WITH HIGH RELIABILITY REQUIREMENTS**
John C. Knight, Samuel T. Gregory, and John I. A. Urquhart Feb. 1984 174 p refs
(Grant NAG1-860)
(NASA-CR-175413; NAS 1.26:175413; UVA/528213/AMCS84/104) Avail: NTIS HC A08/MF A01 CSCL 09B

The use and implementation of Ada (a trade mark of the US Dept. of Defense) in distributed environments in which the hardware are assumed to be unreliable were investigated. The possibility that a distributed system is programmed entirely in Ada so that the individual tasks of the system are unconcerned with which processors they are executing on and failures occurring in the underlying hardware were examined. Author

**N84-22229#** RAND Corp., Santa Monica, Calif.
**SUCCESSFUL USE OF MICROCOMPUTERS IN CLASSROOM INSTRUCTION**
John D. Winkler, Richard J. Shavelson, Cathleen Stasz, and Abby E. Robyn Aug. 1983 16 p refs Presented at Intern. Conf. on Res. in Computer-Based Educ., 3 Jun. 1983 Sponsored in part by National Institute of Education
(RAND/P-6653) Avail: NTIS HC A02/MF A01

The 'success' of classroom computer use was examined within the process of classroom instruction. Several dimensions such as goals, curricula, computer-based learning activities, integration, and feedback were included in the evaluation. The notion of successful computer use focuses on preactive, interactive, and evaluative processes rather than products like standardized test scores, so a naturalistic and field-based research approach is suggested. Knowledgeable teachers may find particular combinations of computer uses to be especially effective, and there may be a further association between particular computer uses and characteristics of the learning environment, such as grade level, subject matter, or ability level of students. M.A.C.

**N84-22230*#** University of Southwestern Louisiana, Lafayette. Dept. of Computer Science.
**A UNIFIED DATA FLOW MODEL FOR FAULT TOLERANT COMPUTERS Final Report**
T. R. Rao, V. V. Ramanamurthy, Abbas Youssefi, and K. M. Kavi (Texas Univ., Arlington) 25 Apr. 1984 40 p refs
(Grant NAG1-271)
(NASA-CR-173479; NAS 1.26:173479) Avail: NTIS HC A03/MF A01 CSCL 09B

The Dataflow Simulation System (DFSS) at USL was used as the medium on which a functional simulaton of sIFT was produced. DFSS is written in PL/I and is supported by MULTICS. Within the simulation, all the interprocessor communication, fault simulation, system state data, and monitoring were implemented in dataflow and supported directly by DFSS. The actual processor level computation was carried out by the SIFT code in PASCAL. The interface between DFSS in PL/I and the SIFT code in PASCAL was supported under a mechanism in DFSS called a Node Realization Module (NRM). Author

**N84-22231#** Purdue Univ., Lafayette, Ind. Dept. of Computer Sciences.
**HIGHLY PARALLEL PROCESSING OF RELATIONAL DATABASES Ph.D. Thesis. Interim Technical Report**
Ching-Chih Hsiao Aug. 1983 136 p
(Contracts N00014-80-K-0816; N00014-81-K-0360)
(AD-A137961; CSD-TR-460) Avail: NTIS HC A07/MF A01 CSCL 09/2

New computer architectures are feasible because of the advances in VLSI design and fabrication technologies. Among them, highly parallel structures coordinate hundreds of thousands of processing elements that function cooperatively. These structures are especially useful in solving computationally intensive problems. This thesis applies the highly parallel approach to improve the efficiency in processing relational database queries. High-performance algorithms for basic relational operations are explored. Efficient composition of these algorithms to process whole queries is also investigated. GRA

**N84-22232#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**STUDY OF FINITE WORD LENGTH EFFECTS IN SOME SPECIAL CLASSES OF DIGITAL FILTERS M.S. Thesis**
H. Inanli Dec. 1983 238 p
(AD-A138082; AFIT/GE/EE/83D-32) Avail: NTIS HC A11/MF A01 CSCL 09/2

One of the main problems in digital filter implementation is that all practical devices are of finite precision. Therefore, the finite word length effect of digital filters is an area of high interest. There are various types of digital filter structures. Due to the effect of finite word length registers, each digital filter structure gives a slightly different output response for the same transfer function. Therefore, it is important to find the best filter structure which has the lowest affect on the output response for the same transfer function. In this paper, six IIR (Infinite Impulse Response) digital filters and six FIR (Finite Impulse Response) digital filters are investigated, theoretically, for the low sensitivity due to a finite work length register. In addition, the six FIR digital filters are simulated by computer to obtain practical results. Finally, it will be shown that NS (Nested Structure) digital filter produce the 'best' response if minimum sensitivity is the figure of merit.Author (GRA)

**N84-22233#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**CPESIM II: A COMPUTER SYSTEM SIMULATION FOR COMPUTER PERFORMANCE EVALUATION USE M.S. Thesis**
D. L. Owen Dec. 1983 314 p
(AD-A138116; AFIT/GCS/EE/83D-16) Avail: NTIS HC A14/MF A01 CSCL 09/2

This report describes the development of an education tool which is used in conjunction with a course in computer performance evaluation. The tool is a system composed of background information and software which simulates a computer system. The student is assigned a position in a fictional computer site, and is given performance problems to solve. The instructor prepares scenarios, constructs a model of the site's workload, and describes the initial computer configuration. The student takes this information and uses it to decide if additional data is required from the hardware and software monitors. The student forms an improvement hypothesis and makes changes to the simulated computer site. Changes to the simulated computer configuration are made by an interactive user interface. The configuration changes, along with the workload description and monitor requests are submitted to the simulation. The simulation uses these inputs to simulate a large mainframe computer with attached software and hardware monitors. Accounting and monitor logs are generated by the simulation. After examining the outputs, the student provides further changes until he is satisfied with the simulated computer site's performance. This document provides a copy of the current software used to imitate the computer, the software used to generate the 'user' interface, and instructions to the instructor and the student on executing the software on the ASD computer systems which support AFIT. GRA

**N84-22234#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**USER-FRIENDLY INTERFACE TO THE ROTH RELATIONAL DATABASE M.S. Thesis. Final Report, 6 Jun. - 16 Dec. 1983**
Dale W. VanKirk 16 Dec. 1983 150 p
(AD-A138153; AFIT/GCS/EE/83D-21) Avail: NTIS HC A07/MF A01 CSCL 09/2

A Friendly Interface to a Relational Algebra Database System was created on the Universal Relation concept. This concept allows the user to relate to the total database as a single relation. The user inputs a query using attributes of the single relation. The interface then creates the Universal Relation by way of relational algebra JOINs. Tuples of this relation are SELECTed according to constraints placed on attributes in the query (i.e. CITY = NEW YORK), and a PROJECTion of attributes desired is made from the result. Limitations of the interface are: 1. All relations in the database must be JOINable without data loss. 2. The query must start with a verb. Author (GRA)

**N84-22235#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**UNIVERSAL DISK CONTROLLER FOR MICROCOMPUTERS M.S. Thesis**
F. N. Elam Dec. 1983 181 p
(AD-A138333; AFIT/GE/EE/83D-20) Avail: NTIS HC A09/MF A01 CSCL 09/2

A highly versatile floppy disk controller was designed and constructed. This disk controller was designed to allow maximum software interfacing to all Shugart 5 in. or 8 in. floppy disk drives. A library of routines was written using the Z80 assembly language. These routines perform all functions necessary to control drive

selection, read/write head movement, and data transfer. The data transfer routines are for use with frequency modulation data encoding and modified frequency modulation data encoding. Three additional Z80 assembly language programs were designed for specific use with three micro computer systems: 'IBM', 'North Star Horizon', and 'NEC 8000'. These system routines are capable of reading and writing an unlimited number of contiguous disk sectors. A file transfer program was written in the 'C' programming language. This program in conjunction with the system routines and library routines is capable of transferring an unlimited number of CP/M files from one system to another. Author (GRA)

**N84-22236#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**NATURAL LANGUAGE PROCESSOR AS A UNIVERSAL FRONT END TO EXPERT SYSTEMS M.S. Thesis**
D. L. Brooke Dec. 1983 126 p
(AD-A138455; AFIT/GE/EE/83D-13) Avail: NTIS HC A07/MF A01 CSCL 09/2

This thesis specifies a list of features which must be included in a transportable natural language processor (NLP) used as a front-end to expert systems used by Air Force personnel. It also places requirements on the expert systems themselves in order to interface with such a NLP. Author (GRA)

**N84-22237#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**EFFECTS OF COMPUTER ARCHITECTURE ON FFT (FAST FOURIER TRANSFORM) ALGORITHM PERFORMANCE M.S. Thesis**
M. A. Mehalic Dec. 1983 287 p
(AD-A138465; AFIT/GE/EE/83D-47) Avail: NTIS HC A13/MF A01 CSCL 12/1

This study examines the effects of computer architecture on FFT algorithm performance. The computer architectures evaluated are those of the Cray-1, CDC Cyber 750, IBM 370/155, DEC VAX 11/780, DEC PDP 11/60, DEC PDP 11/50, and Cromemco Z-2D. The algorithms executed are the radix-2, mixed-radix FFT (MFFT), Winograd Fourier Transform Algorithm (WFTA), and prime factor algorithm (PFA). The execution time of each algorithm for different sequence lengths is determined for each computer. Then the number of assembly language instructions executed are determined for the following categories: data transfers, floating point additions and subtractions, floating point multiplications and divisions, and integer operations. The correlation coefficients between the number of assembly language instructions in each category and the algorithm execution speeds are determined for each computer. The values of the correlation coefficients are then related to the computer architectures. The computer architectures are then compared against each other to determine what features are desirable in an FFT processor. GRA

**N84-22238#** Bendix Corp., Kansas City, Mo.
**IEEE 488 BUS PSEUDO-CONTROLLER LINKING TALKER WITH LISTENER**
G. M. Hale Feb. 1984 15 p refs
(Contract DE-AC04-76DP-00613)
(DE84-007093; BDX-613-3033) Avail: NTIS HC A02/MF A01

A circuit is described that places talker/listener addresses on an IEEE 488 bus. This circuit is applied together with an ICS Electronics Corporation Model 4824 IEEE 488 Bus Serial Interface Card to permit a dEC VT (trademarks of Digital Equipment Corporation) 102 terminal to copy to a Commodore Model 2022 printer. The circuit takes the place of a controller to initiate the bus link. Command conflicts between the VT102 and the 2022 restrict the printer operation to the uppercase mode. DOE

**N84-22239#** New York Univ., New York. Mathematics and Computing Lab.
**COMPARING THE NYU ULTRACOMPUTER WITH OTHER LARGE-SCALE PARALLEL PROCESSORS**
Allan Gottlieb Nov. 1983 12 p refs
(Contract DE-AC02-76ER-03077; Grant NSF MCS-79-21258)
(DE84-006043; DOE/ER-03077/205) Avail: NTIS HC A02/MF A01

The proposed NYU Ultracomputer, a shared memory MIMD parallel machine composed of thousands of autonomous processing elements is described. This machine uses an enhanced message switching network having the topology of an (UC OMEGA)-network to approximate the ideal of conflict-free access to a common memory and to implement efficiently a new fetch-and-add synchronization primitive. The hardware required to construct such a system, consisting of 4096 processors, using 1990 technology is outlined. Work indicating how the goal of a distributed operating system free from serial bottlenecks can be achieved by employing the fetch-and-add primitive is discussed. The Ultracomputer project is compared with other research in parallel processing. DOE

**N84-22211*#** Boeing Computer Services, Inc., Seattle, Wash.
**MANAGING GEOMETRIC INFORMATION WITH A DATA BASE MANAGEMENT SYSTEM**
R. P. Dube *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 241-254 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22357#** Joint Publications Research Service, Arlington, Va.
**CONCERTED EFFORT FOR NATIONWIDE COMPUTER LITERACY**
Gyorgy Paris *In its* East Europe Rept.: Sci. Affairs (JPRS-ESA-84-010) 9 Apr. 1984 p 1-8 Transl. into ENGLISH from Koznveveles (Budapest), 17 Feb. 1984 p 10-14 (For primary document see N84-22356 12-70)
Avail: NTIS HC A03/MF A01

# 61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

**N84-22240** National Physical Lab., Teddington (England). Div. of Quantum Metrology.
**APPLICATION OF THE PAFEC 75 SOFTWARE PACKAGE**
K. J. Dineen Aug. 1983 113 p refs
(NPL-QU-66; ISSN-0309-3050) Copyright. Avail: Issuing Activity

Static displacement and stress analysis facilities of the PAFEC package, and application to one and three dimensional structures are outlined. Author (ESA)

**N84-22241#** Argonne National Lab., Ill.
**INSTALLATION REPRESENTATIVE GUIDE**
May 1983 38 p refs
(DE83-008451; ANL/NESC-1-(Rev.)) Avail: NTIS HC A03/MF A01

This guide is intended as an introduction and reference manual to the program and operating procedures of the National Energy Software Center (NESC). The major objectives of the NESC program are: to promote the sharing of computer software among agency offices and contractors; to facilitate the transfer of agency developed computer applications and technology to the information processing community; and to provide the focal point for DOE software exchange arrangements with other government agencies and for coordination of DOE acquisition of nongovernment software. Author

**N84-22242*#** Computer Software Management and Information Center, Athens, Ga.
**COSMIC SOFTWARE CATALOG, 1984 EDITION Annual Report**
1984 483 p
(Contract NASw-3247)
(NASA-CR-174576; NAS 1.26:174576) Avail: COSMIC, Athens, Georgia 30602 HC $25.00 CSCL 09B

This publication contains descriptions of the software supplied by NASA's Computer Software Management and Information Center. Abstracts for 1349 NASA-sponsored computer programs are included. M.G.

**N84-22243*#** Informatics, Inc., Palo Alto, Calif.
**CDC TO CRAY FORTRAN CONVERSION MANUAL**
C. McGary and D. Diebert Oct. 1983 22 p
(Contract NAS2-11555)
(NASA-CR-166574; NAS 1.26:166574) Avail: NTIS HC A02/MF A01 CSCL 09B

Documentation describing software differences between two general purpose computers for scientific applications is presented. Descriptions of the use of the FORTRAN and FORTRAN 77 high level programming language on a CDC 7600 under SCOPE and a CRAY XMP under COS are offered. Itemized differences of the FORTRAN language sets of the two machines are also included. The material is accompanied by numerous examples of preferred programming techniques for the two machines. M.A.C.

**N84-22244#** RAND Corp., Santa Monica, Calif.
**SELF-TEACHING GUIDE TO RAND'S TEXT PROCESSOR**
Oct. 1983 228 p refs Revised
(RAND/N-2056-RC-Rev) Avail: NTIS HC A11/MF A01

A manual that describes the function and format techniques of the Rand Text Processing System is presented. The basic components of the text processor are a computer system, a program, a terminal that consists of a TV-like display and a typewriter-like keyboard, and various printers and storage devices connected to the computer. The manual allows the user to utilize the system for text generation and manipulation, electronic message sending and receiving, file management and accounting. M.A.C.

**N84-22245*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**OBSERVATION MODEL AND PARAMETER PARTIALS FOR THE JPL VLBI PARAMETER ESTIMATION SOFTWARE MASTERFIT-V1.0**
J. L. Fanselow 15 Dec. 1983 59 p refs
(Contract NAS7-100)
(NASA-CR-173455; JPL-Pub-83-39; NAS 1.26:173455) Avail: NTIS HC A04/MF A01 CSCL 09B

The model used in the parameter estimation software for the analysis of very long baseline interferometry (VLBI) data is described. The model components of geometry, clocks, the troposphere, and the ionosphere are covered. No attempt is made to describe the parameter adjustment portion of the software. Wave front, perturbation, nutation and time equations are used to illustrate the applications of the modeling techniques. M.A.C.

**N84-22246#** Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
**FEED (FIELD EXPLOITATION OF ELEVATION DATA) SOFTWARE DOCUMENTATION Contract Report, 24 Aug. 1982 - 31 Jan. 1983**
J. G. Jay and E. A. Anderson Aug. 1983 282 p
(Contract DAAK70-82-K-0204)
(AD-A137977; ETL-0335) Avail: NTIS HC A13/MF A01 CSCL 09/2

This report provides programmer-level documentation which describes the FEED Software, structure, files, data, and procedures. The Georgia Institute of Technology Engineering Experiment Station is working with the U.S. Army Engineer Topographic Laboratories (ETL) to combine the existing capabilities of the FEED system with the elevation data algorithms and enhancements from the Digital Terrain Analysis Station to form a more generic, more machine-independent software system. Based on 16-bit minicomputer technology, this system will provide the Field Army with a capability for exploiting digital terrain elevation data and associated products by the first quarter of FY85. A follow-on capability in digital terrain elevation data products will be incorporated as part of the Terrain Analyst Work Station, which is also being developed by ETL and will take advantage of 32-bit minicomputer technology and the concept of devices-independent graphics. This report documents the existing FEED software, which is the starting point for the development work referred to above. The FEED software is currently available for the Data General family of minicomputers using Tektronix PLOT10 graphics commands. GRA

**N84-22247#** Stanford Univ., Calif. Electronics Lab.
**COMPUTER MODELING OF COMPLETE IC FABRICATION PROCESS Final Report, 16 Jun. 1980 - 15 Jun. 1983**
Robert W. Dutton Jan. 1984 83 p
(Contract DAAG29-80-K-0013)
(AD-A138006; ARO-17163.11-EL) Avail: NTIS HC A05/MF A01 CSCL 09/2

Process and device modeling, especially in two-dimensions, for the complete integrated circuit fabrication process is reported. New understanding of oxidation and diffusion effects in silicon are reported and new computer tools and techniques are discussed. Device simulation is coupled to process modeling and new results for both short- and narrow-channel devices are reported. Non-planar device simulators, both poisson and two-carrier capabilities, have been developed. New techniques have been developed for parameter extraction and measurements. Author (GRA)

**N84-22248#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**A SYNTAX DIRECTED EDITOR ENVIRONMENT M.S. Thesis**
John R. Koslow 5 Dec. 1983 110 p
(AD-A138009; AFIT/GCS/MA/83D-3) Avail: NTIS HC A06/MF A01 CSCL 09/2

This document describes the implementation and modification of a software development environment for a medium size computer based on a syntax directed editor. Although it was developed for use with the ADA programming language, most of the environment is driven by a language syntax description, and can therefore process virtually any current or future programming language. This environment is an extension of a prototype developed previously at the Air Force Institute of Technology. Author (GRA)

**N84-22249#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**SIRE: AN AUTOMATED SOFTWARE DEVELOPMENT ENVIRONMENT M.S. Thesis**
D. W. Nettles Dec. 1983 149 p
(AD-A138022; AFIT/GCS/MA/83D-5) Avail: NTIS HC A07/MF A01 CSCL 09/2

The objective of this thesis is to perform the preliminary design and partial development of an automated software development environment (ASDE). This environment, called Sire, is intended to support the design and production of software using automated and interactive tools. Sire is to be a system that aids the software designers and programmers through the use of an integrated and flexible set of tools that are intended to reduce the amount of work that is done by humans. This reduced workload will free the system designers/implementors for more productive work. As part of this investigation, a partial implementation of Sire is accomplished. This implementation allows the user to input a system design in a specification language. Sire will then produce a correct source program shell for the user to use for the detailed implementation stage. Author (GRA)

**N84-22250#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**INTERACTIVE COMPUTER GRAPHICS FOR SYSTEM ANALYSIS M.S. Thesis**
M. A. Travis Dec. 1983 202 p
(AD-A138025; AD-E750873; AFIT/GE/EE/83D-66) Avail: NTIS HC A10/MF A01 CSCL 05/1

The possible applications of computer graphics for control system design are considered in this thesis. The functional requirements of such a system are identified and discussed. Other

topics such as graphics software, programming languages, user interface, and software design are vital to such an effort and are examined in detail. Based on the desirable features of device independent graphics, an implementation of the ACM/SIGGRAPH Core Standard Proposal is selected. To demonstrate the various applications for system analysis, a group of functions for analysis of continuous systems is implemented and tested. Sample results are provided and recommendations for further work are discussed. Author (GRA)

**N84-22251#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**ADA1: AN ADA SUBSET COMPILER FOR THE AFIT SYNTAX DIRECTED PROGRAMMING ENVIRONMENT M.S. Thesis**

M. L. McCracken 5 Dec. 1983 217 p

(AD-A138027; AD-E750873; AFIT/GCS/MA/83D-4) Avail: NTIS HC A10/MF A01 CSCL 09/2

This document describes the effort involved in moving the Ada0 compiler and interpreter developed by Capt. Scott E. Ferguson as part of the AFIT syntax directed editor environment from a microcomputer to the VAX 11/780. As part of this effort the compiler and interpreter were expanded to accept a larger subset of Ada. The compiler and interpreter work with an abstract syntax representation of a computer program produced by the syntax directed editor. This abstract representation, which is guaranteed to be syntactically correct, makes the compiler much easier to write and understand. The compiler in a top-down compiler but no backtracking is needed since the program is known to be syntactically correct. The interpreter is able to use the abstract representation to give the user an interactive display of the program during execution. Designs to allow overloading of names and operators, and passing parameters to subprograms are also presented. Author (GRA)

**N84-22252#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**EXPLORATION OF DOSE-RESPONSE TECHNIQUES WITH SOME APPLICATIONS TO A SIMULATION PROBLEM M.S. Thesis**

L. G. Kehl Dec. 1983 113 p

(AD-A138029; AD-E750873; AFIT/GOR/MA/83D-4) Avail: NTIS HC A06/MF A01 CSCL 09/2

The United States Air Force has, over the past decade or so, invested much time and money in computer simulations and models. At the most basic level almost all of these simulations are input-output type procedures; variables of interest are changed to determine the effect they have on some other factor. This process is virtually indistinguishable from dose-response problems in bio-assay, hence, is capable of being analyzed by the same methods used in bio-assay. The two most commonly used techniques are probit and logit, but there are many other available techniques. An alternative to performing numerous, and sometimes redundant, simulations is to use these techniques whenever possible. Data from the Avionics Evaluation Program were used as the basis for estimating the probability of aircraft abort, based on the mean-time-between-failure of various equipment items, using four quantal assay techniques. The fits obtained from these models were compared to the more popular probit and logit results previously obtained by Dr. David Barr. Author (GRA)

**N84-22253#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**A GENERATOR OF RECURSIVE DESCENT PARSERS FOR LL(k) LANGUAGES M.S. Thesis**

George. B. Paprotny Dec. 1983 312 p

(AD-A138061; AFIT/GCS/MA/83D-6) Avail: NTIS HC A14/MF A01 CSCL 09/2

A computer program was designed to generate a recursive-descent compiler for LL(k) languages. A grammar specification language was designed using Extended BNF, along with a lexical analyzer specification language using regular expressions. The program uses a well-tested but not formally proven method for determining the maximum possible k for a grammar. It then uses an iterative first and follow set calculation algorithm to determine the actual k for the grammar. GRA

**N84-22254#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**A NATURAL LANGUAGE INTERFACE FOR A PROLOG DATA-BASE M.S. Thesis**

R. P. White 16 Dec. 1983 85 p

(AD-A138071; AFIT/GCS/EE/83D-22) Avail: NTIS HC A05/MF A01 CSCL 09/2

A natural language (NL) interface to a relational data base was developed with careful consideration given to the human factors needed to aid a novice user in accessing data. The entire system is written in DEC-10 PROLOG, with three distinguishing contributions: A simple grammar was developed to parse phrases like: 'officers where rank is captain and status is single and age is less than 32'; the developed NL compiler accepts English phrases or commands as queries and translates them into PROLOG; The human factors that contribute to the system are: a help file to aid user perception of the data, a simple grammar, an interactive view of all retrieved tuples, two forms of ellipsis, user defined aliases, and limited use of quantifiers. GRA

**N84-22255#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**AN APPROACH FOR MULTILAYER PCB (PRINTED CIRCUIT BOARDS) DESIGN WITH AUTOMATIC ROUTING M.S. Thesis**

D. V. Hibner Dec. 1983 139 p

(AD-A138072; AFIT/GE/EE/83D-29) Avail: NTIS HC A07/MF A01 CSCL 09/2

A computer aided design (CAD) tool for the design of multilayer printed circuit boards with automatic routing was designed which used the Stanford University designed Chip Layout Language (CLL), an integrated circuit CAD tool, to produce the output plot and the final fabrication file. The routing algorithm used was based on the line probe algorithm and was defined for multipoint paths. The system was not implemented. The design rules for a multilayer printed circuit board (PCB) are stated and explained. The system design is presented in Chapter 3 with the definition of the PCB programming language. The detail design is presented in Chapter 4 with the pseudo-coding for the system. Also, a method for adjusting the Caltech intermediate format (CIF) output of CLL to a CIF output acceptable for PCB fabrication is discussed in Chapter 4. Finally, CLL is detailed in the appendix with the insight gained from the source code. Author (GRA)

**N84-22256#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**DETAILED DESIGN AND IMPLEMENTATION OF A MULTI-PROGRAMMING OPERATING SYSTEM FOR SIXTEEN-BIT MICROPROCESSORS M.S. Thesis**

R. K. Miller Dec. 1983 248 p

(AD-A138078; AFIT/GCS/EE/83D-14) Avail: NTIS HC A11/MF A01 CSCL 09/2

The purpose of this project is to continue the design and implementation of a multiprocessing operating system for sixteen-bit microcomputers. A multiprogramming operating system, designated Air Force Institute of Technology (AFIT) Multiprogramming Operating System (AMOS), for the AFIT Digital Engineering Laboratory was designed at the detailed level and fully implemented, except for the assembly language routines. The requirements were developed in the works of Yusko, Ross, and Huneycutt. This effort covers the detailed design and implementation of the overall system, the detailed design and implementation of the operating system memory manager, and the specifications for the secondary storage. GRA

**N84-22257#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**DETAILED DESIGN AND IMPLEMENTATION OF A MULTI-PROGRAMMING OPERATING SYSTEM FOR SIXTEEN-BIT MICROPROCESSORS M.S. Thesis**

P. E. Cruser Dec. 1983 254 p

(AD-A138083; AFIT/GCS/EE/83D-5) Avail: NTIS HC A12/MF A01 CSCL 09/2

A multiprogramming operating system, designated AFIT Multiprogramming Operating System (AMOS), for the AFIT Digital Engineering Laboratory was designed at the detailed level and fully implemented, except for the assembly language routines. The requirements were developed in the works of Yusko, Ross, and Huneycutt. This thesis effort was done in conjunction with the effort of Lt. Ronald K. Miller. This effort covers the detailed design and implementation of the overall system and, also, covers the detailed design and implementation of the operating system scheduler. Author (GRA)

**N84-22258#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**EFFICIENT COMPUTER ARCHITECTURES FOR COMPUTING DISCRETE FOURIER TRANSFORMS M.S. Thesis**

G. P. Route Dec. 1981 336 p

(AD-A138109; AFIT/GE/EE/81D-50) Avail: NTIS HC A15/MF A01 CSCL 09/2

The effects of the IBM 370-155, CDC Cyber 750, Cray-1, and PDP 11/60 architectures on executing selected Discrete Fourier Transform (DFT) algorithms are investigated. The selected DFT algorithms are the radic-2 FFT, mixed-radix FFT, Winograd Fourier Transform Algorithm (WFTA), and Prime Factor Algorithm (PFA). The overall execution times on each computer system is determined. For the IBM 370/155 and CDC Cyber 750, the number and type of instructions and the execution time required for each portion of the FFT programs is determined. This study shows that the number of floating-point additions and multiplications required by the FFT programs determine these programs' execution times on the IBM 370/155. This study also investigated the relationship between the number of a processor's general-purpose registers and the number of data transfers required by an FFT program. Results from the IBM 370/155 and Cyber 750 systems showed that the computer system with fewer registers required more data transfers. GRA

**N84-22259#** Ohio State Univ., Columbus.

**ANALYZING PROGRAM METHODOLOGIES USING SOFTWARE SCIENCE Final Report, 1 Aug. 1980 - 31 Dec. 1983**

W. H. Zweben Jan. 1984 12 p

(Contract DAAG29-80-K-0061)

(AD-A138121; ARO-17150.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

The ultimate goal of the research program is to enhance the quality of computer software. In order to accomplish this goal, however, there have to be agreed upon notions of just what quality means and how it can be assessed. This project sought to make contribution to our understanding of these issues. One of the specific objectives of this project was to study software science metrics in the COBOL arena, another objective concerned the evaluation of principles of software development. Research also sought to examine instruments alternative to the comprehension test which are easier to create but which are still reliable and valid means of measuring one's understanding of a piece of software. Author (GRA)

**N84-22260#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**AN AUTOMATED COMPUTER COMMUNICATION NETWORK PROTOCOL VERIFICATION SYSTEM M.S. Thesis**

Kenneth R. Martin, Jr. Dec. 1983 220 p

(AD-A138160; AFIT/GCS/EE/83D-12) Avail: NTIS HC A10/MF A01 CSCL 09/2

An automated tool for computer network communication protocol validation was developed and implemented. The method utilyzes the Program Modeling Language (PPML) to specify the protocol and an automated procedure to convert the PPML description into an equivalent Evaluation Net in order to evaluate the protocol. Simulation techniques are used to exercise the Evaluation Net presenting data on message transmission times and global state generation. Author (GRA)

**N84-22261#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**GRID-BASED LINE DRAWING QUANTIZATION M.S. Thesis**

E. A. Thompson Dec. 1983 93 p

(AD-A138194; AFIT/GCS/EE/83D-20) Avail: NTIS HC A05/MF A01 CSCL 09/2

This paper documents a quantitative analysis of the performance of the generalized chain codes when used to quantize waveforms of specific degrees of curvature. The analysis was performed using a software simulation of the chain coding system on periodic circular and sinusoid waves. The performance of the codes was measured in terms of the number of encoded bits per length of the function and the area error per length. The analytic measure of the curvature of the circular and sine wave was developed so that the performance of the codes could be evaluated as a function of the curvature of the waveform being quantized. Comparisons on the circular wave provided a baseline of a constant curvature function. The performance of the coding system was the compared to the results when sine functions of similar curvature were encoded to determine if curvature is a valid predictor of the performance of the chain code system. Author (GRA)

**N84-22262#** Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.

**RELIABILITY MODEL DEMONSTRATION STUDY, VOLUME 1 Final Technical Report, Aug. 1980 - Mar. 1983**

J. E. Angus, J. B. Bowen, and S. J. VanDenBerg Griffiss AFB, N.Y. RADC Aug. 1983 303 p 2 Vol.

(Contract F30602-80-C-0273; AF Proj. 2527)

(AD-A138196; RADC-TR-83-207-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 09/2

The objective of this study was to demonstrate the use and applicability to Air Force software acquisition managers of six quantitative software reliability models to a major command, control, communications, and intelligence (C3I) system. The scope of the effort involved the collection of software error data from an ongoing C3I project, fitting the six models to the data thus collected, analysis of the predictions provided by the models, and the development of conclusions, recommendations, and guidelines for software acquisition managers pertaining to the use and applicability of the six software reliability models. GRA

**N84-22263#** Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.

**RELIABILITY MODEL DEMONSTRATION STUDY, VOLUME 2 Final Technical Report, Aug. 1980 - Mar. 1983**

J. E. Angus, J. B. Bowen, and S. J. VanDenBerg Griffiss AFB, N.Y. RADC Aug. 1983 143 p 2 Vol.

(Contract F30602-80-C-0273; AF Proj. 2527)

(AD-A138197; RADC-TR-83-207-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report contains the results of a study to determine the use and applicability to Air Force software acquisition managers of six quantitative software reliability models to a major command, control, communications, and intelligence (C3I) system. The scope of the study included the collection of software error data from an on going C3I project, fitting six software reliability models to the data, analyzing the predictions provided by the models, and developing conclusions, recommendations, and guidelines for software acquisition managers pertaining to the use and applicability of the models. GRA

**N84-22264#** George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.

**CONVEXITY AND CONCAVITY PROPERTIES OF THE OPTIMAL VALUE FUNCTION IN PARAMETRIC NONLINEAR PROGRAMMING**

A. V. Fiacco and J. Kyparisis 21 Dec. 1982 63 p

(Contract N00014-75-C-0729; Grant NSF ECS-82-01370)

(AD-A138202; GWU/IMSE/SERIAL-T-471/82) Avail: NTIS HC A04/MF A01 CSCL 12/2

Convexity and concavity properties of the optimal value function $f^*$ are considered for the general parametric optimization problem

P (E) of the form min f(x,E) s.t. x E R(E). Such properties of f* and the solution set map S* form an important part of the theoretical basis for sensitivity, stability, and parametric analysis in mathematical optimization. Sufficient conditions are given for several standard types of convexity and concavity of f*, in terms of respective convexity and concavity assumptions on f and the feasible region point-to-set map R. Specializations of these results to the general parametric inequality-equality constrained nonlinear programming problem and its right-hand-side version are provided. Convexity properties of the solution point-to-set map S* for the general problem P(E) are also briefly considered. Although most of the results appear to be new, some basic results were obtained previously in a somewhat different setting. These are included here and related to the new developments, thus providing the first comprehensive survey of these important characterizations. Author (GRA)

**N84-22265#** George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
**GENERALIZED CONVEXITY AND CONCAVITY PROPERTIES OF THE OPTIMAL VALUE FUNCTION IN PARAMETRIC NONLINEAR PROGRAMMING**
A. V. Fiacco and J. Kyparisis 11 Apr. 1983 49 p
(Contract N00014-83-K-0215; Grant NSF ECS-82-01370)
(AD-A138220; GWU/IMSE/SERIAL-T-472/83) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers generalized convexity and concavity properties of the optimal value function f* for the general parametric optimization problem P(e) of the form min x sub f (x,e) s.t. x epsilon R(e). Many results on convexity and concavity characterizations of f* were presented by the authors in a previous paper. Such properties of f* and the solution map S* form an important part of the theoretical basis for sensitivity, stability and parametric analysis in mathematical optimization. The authors give sufficient conditions for several types of generalized convexity and concavity of f*, in terms of respective generalized convexity and concavity assumptions on f and convexity and concavity assumptions on the feasible region point-to-set map R. Specializations of these results to the general parametric inequality-equality constrained nonlinear programming problem and its right-hand-side version are provided. Author (GRA)

**N84-22266#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PLACING HIDDEN SURFACE REMOVAL WITHIN THE CORE GRAPHICS STANDARD: AN EXAMPLE M.S. Thesis**
T. S. Wailes 7 Dec. 1983 164 p Original contains color illustrations
(AD-A138239; AFIT/GCS/MA/83D-9) Avail: NTIS HC A08/MF A01 CSCL 09/2

A Pascal based ACM proposed standard (CORE) graphics system from the University of Pennsylvania was converted to run on an 086/8087 microcomputer. Additionally, a non-restrictive full 3-D hidden surface removal algorithm for surfaces modelled by opaque polygons was implemented. This algorithm is an extension of the list priority algorithm created by Newell, Newell, and Sacha. By saving the priority list created by the algorithm from one batch of updates to the next, computational savings are possible. Although the present algorithm can only be used on raster type display surfaces, this algorithm could be used as a prelude to other scan line hidden surface removal algorithms to provide support for vector type displays. Author (GRA)

**N84-22267#** Institute for Defense Analyses, Alexandria, Va. Computer and Software Engineering Div.
**REPORT OF FINDINGS AND RECOMMENDATIONS: SOFTWARE ENGINEERING INSTITUTE STUDY PANEL Final Report, May - Oct. 1983**
N. S. Eastman Dec. 1983 46 p
(Contract MDA903-79-C-0018)
(AD-A138282; AD-E500618; IDA-D-49; IDA/HQ-83-28304) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Software Engineering Institute Study Panel (SEISP) was put together to form an independent assessment of the proposed, Strategy for the Software Technology for Adaptable, Reliable Systems (STARS) Program which recommended the establishment of a Software Engineering Institute (SEI) to bridge the gap between R&D activities that demonstrate new techniques and the exploitation of those techniques in system developments in order to effect a significant and rapid improvement in the means of development and support of computer software for mission-critical defense systems. The first and most important conclusion of the Panel is that a Software Engineering Institute is essential to achieving STARS goals and must be established with the greatest possible speed. GRA

**N84-22268#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**ROBUST MULTIVARIABLE CONTROLLER DESIGN VIA IMPLICIT MODEL-FOLLOWING METHODS M.S. Thesis**
W. G. Miller Dec. 1983 349 p
(AD-A138309; AFIT/GE/EE/83D-48) Avail: NTIS HC A15/MF A01 CSCL 14/2

This study applies the concept of implicit model-following to the design of a multivariate control system based on the Linear system model, Quadratic cost, and Gaussian noise process assumptions of optimal control. The design objective is to achieve improved controller robustness in the face of uncertainties arising from the differences between the simplified linear model used for controller design, and a more realistic truth model representation which includes higher-order dynamics, parameter variations, and nonlinearities. This report introduces the concept of implicit model-following and reviews the formulation of its incorporation into the design of a controller that consists of a Command Generator Tracker employing a Proportional-plus-Integral inner-loop regulator and, if required, a Kalman Filter to provide state estimates for feedback control (CGT/PI/KF controller). The theoretical background for the application of matrix singular value analysis to the study of controller robustness is presented, and a computer program is developed to apply this type of analysis of the general CGT/PI/KF controller configuration. Author (GRA)

**N84-22269#** Naval Postgraduate School, Monterey, Calif.
**SOME LINKS BETWEEN TURTLE GEOMETRY AND ANALYTIC GEOMETRY**
N. C. Rowe Jan. 1984 18 p
(RR0-0001)
(AD-A138319; NPS52-84-002) Avail: NTIS HC A02/MF A01 CSCL 09/2

The computer language Logo facilities the teaching of analytic geometry and calculus from the notion of curvature, through its turtle geometry facility. The author provides some theoretical basis for finding turtle geometry equivalents of familiar curves in analytic geometry, and vice versa, by some simple methods apparently previously unnoticed. In particular, he studied turtle geometry programs where the curvature of a line is a trigonometric function of its orientation. Author (GRA)

**N84-22270#** Naval Postgraduate School, Monterey, Calif.
**METHODOLOGY FOR BENEFIT ANALYSIS OF CAD/CAM (COMPUTER-AIDED DESIGN/COMPUTER-AIDED MANUFACTURING) IN USN SHIPYARDS M.S. Thesis**
R. B. Grahlman Mar. 1984 87 p
(AD-A138398) Avail: NTIS HC A05/MF A01 CSCL 09/2

This thesis expands the concept of Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) in naval shipbuilding to include maintenance. This inclusion is coupled with the integration of the design and manufacturing processes in the acronym CIDMM, which stands for Computer-Integrated Design, Manufacture and Maintenance. A methodology is proposed to identify and measure the tangible and intangible benefits derived from CAD/CAM in naval shipbuilding. The methodology is flexible enough to be applied to future CIDMM systems. A decision-aid for assessing the intangible benefits and a structure for computing the time benefits are proposed in the methodology. Author (GRA)

**N84-22271#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**IMPLEMENTATION AND EVALUATION OF A CORE GRAPHICS SYSTEM ON A VAX 11/780 COMPUTER WITH A UNIX OPERATING SYSTEM M.S. Thesis**
J. W. Taylor Dec. 1983 227 p
(AD-A138406; AFIT/GCS/MA/83D-8) Avail: NTIS
HC A11/MF A01 CSCL 09/2

A Pascal Core System using the VAX VMS 11/780 operating system from the University of Pennsylvania was converted to run on the Air Force Institute of Technology (AFIT) VAX 11/780 UNIX operating system. Major problems in converting from the VMS operating system to the UNIX operating system were encountered, but they were solved and documented for others to use and avoid. The size of the Pascal Core System and its lengthy compile times were a major system limitation. Device drivers were written in C for the Visual 550, the Tektronics 4014, and the Hewlett Packard 7220A 4 color plotter and can be applied to other projects. The Core package that was converted follows the SIGGRAPH 1979 standard. An application program, called intcore.run, is available that demonstrates the Pascal Core routines that are supported by this system. Author (GRA)

**N84-22272#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**A MICROCOMPUTER BASED SYSTEM FOR ANALYSIS OF LINE DRAWING QUANTIZATION TECHNIQUES M.S. Thesis**
J. E. Rock, Jr. 9 Dec. 1983 110 p
(AD-A138413; AFIT/GE/EE/83D-77) Avail: NTIS
HC A06/MF A01 CSCL 09/2

This paper documents the design and implementation of a system for analysis of line drawing quantization techniques on a microcomputer system. The system provides software tools for the input, output, and analysis of line drawings and their quantized representations. The system uses a digitized version of the original line drawing as the basis for all performance calculations. A program to compute the single rich chain code of the input digitized line drawing was implemented. The performance of the chain coded versions of the line drawings could then be calculated. This project developed all the necessary tools for the analysis of any line drawing quantization technique that can be implemented on a microcomputer system. Author (GRA)

**N84-22273#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**DESIGN AND IMPLEMENTATION OF AN INPUT/OUTPUT INTERFACE PROTOCOL FOR THE INTEL 432/670 COMPUTER SYSTEM M.S. Thesis**
K. N. Cole Dec. 1983 325 p
(AD-A138429; AFIT/GE/EE/83D-17) Avail: NTIS
HC A14/MF A01 CSCL 17/2

Distributed computer systems have many advantages to offer in terms of simplicity, efficiency, protection, and security as well as improved performance from the concurrency in such a system. Communication among distributed processors is a key issue in the design of a distributed system. While the lower levels of a communication system are generally defined by the hardware configuration and thus, implementation dependent, protocols for communication may be developed at higher levels that are independent of the hardware implementation. Using the Computer Based Message System under the development for the National Bureau of Standards, this thesis investigation is an attempt to develop a usable I/O interface for a distributed computer system. The Intel 432 Micromainframe computer system is a functionally distributed multiprocessor system. The hardware organization and operating system features lend themselves to the implementation of a message based communication system among users and devices on distinct processor. This specific research effort involves defining the protocol requirements, as well as designing, implementing and testing a distributed I/O system communication interface on the 432 computer system. Author (GRA)

**N84-22274#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**A CANDIDATE PROGRAMMING LANGUAGE M.S. Thesis**
R. Jennings Dec. 1983 145 p
(AD-A138433; AFIT/GA/EE/83D-1) Avail: NTIS
HC A07/MF A01 CSCL 09/2

Conventional computer architecture are obsolete. They are performance limited, unreliable and hard to program. In addition, they are able to make very inefficient use of the currently available microelectronic technology. This state is perpetuated by the attempt to seek new languages, new operating systems, and new hardware independently; the desire to maintain compatibility with existing systems; and the desire to design with integrated circuits (VLSI) as tiny TTL. This mold is broken by the description of an architecture in which the language, software, and hardware are all designed synergistically, constrained only by the characteristics of the users of automation: people. A candidate language is described and compared with C. Some characteristics of a program support environment are suggested. The hardware structures implied by the proposed architecture are described. Finally, two examples are provided which demonstrate the language. While the next computer architecture to be used for 40 years is not described, enough ideas are described in detail to provide a stimulus and direction to researchers who have been convinced by contemporary computer systems that THERE HAS GOT TO BE A BETTER WAY. Author (GRA)

**N84-22275#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PLAFST PROGRAMMABLE LOGIC ARRAY FROM STATE TABLE M.S. Thesis**
D. C. Pelan Dec. 1983 140 p
(AD-A138466; AFIT/GE/EE/83D-57) Avail: NTIS
HC A07/MF A01 CSCL 09/2

Programmable Logic Array From State Table (PLAFST) is a computer aided design tool that takes a symbolic state table as input and produces a very large scale integrated (VLSI) circuit implementation of the symbolic state table. The state table is first reduced symbolically using equivalence partitioning. A near optimal binary state assignment is made based on the Story, Harrison, and Reinhard procedure as modified by Noe and Ryhne. Distinct state assignment variables are sorted based on cost estimates obtained by increasing the number of adjacencies in the state transition table. Once sorted, the actual costs of valid state assignments made from the state variables are calculated. Since state assignments with the lowest cost estimates are investigated first, and optimal solution is found with a small number of iterations. This binary state assignment is demonstratably less costly than either simple or gray code assignments of the state variables. The VLSI circuit consists of a programmable logic array and clocked buffers. The state buffers are properly interconnected. The final outputs are Chip Layout Language and Caltech Intermediate Format descriptions of the integrated circuit. PLAFST also plots the final integrated circuit. Author (GRA)

**N84-22276#** Boeing Aerospace Co., Seattle, Wash.
**SOFTWARE INTEROPERABILITY AND REUSABILITY, VOLUME 1 Final Technical Report, Aug. 1980 - Feb. 1983**
P. E. Presson, J. Tsai, T. P. Bowen, J. V. Post, and R. Schmidt
Griffiss AFB, N.Y. RADC Jul. 1983 171 p
(Contract F30602-80-C-0265; AF Proj. 5581)
(AD-A138477; RADC-TR-83-174-Vol-1) Avail: NTIS
HC A08/MF A01 CSCL 09/2

Software metrics (or measurements) which predict software quality were extended from previous research to include two additional quality factors: interoperability and reusability. Aspects of requirements, design, and source language programs which could affect these two quality factors were identified and metrics to measure them were defined. These aspects were identified by theoretical analysis, literature search, interviews with project managers and software engineers, and personal experience. A Guidebook for Software Quality Measurement was produced to

assist in setting quality goals, applying metrics and making quality assessments. Author (GRA)

**N84-22277#** Boeing Aerospace Co., Seattle, Wash.
**SOFTWARE INTEROPERABILITY AND REUSABILITY. VOLUME 2: GUIDEBOOK FOR SOFTWARE QUALITY MEASUREMENT Final Technical Report, Aug. 1980 - Feb. 1983**
P. E. Presson, J. Tsai, T. P. Bowen, J. V. Post, and R. Schmidt Griffiss AFB, N.Y. RADC Jul. 1983 272 p
(Contract F30602-80-C-0265; AF Proj. 5581)
(AD-A138478; RADC-TR-83-174-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 09/2

The purpose of this guidebook is to present a complete set of procedures and guidelines for introducing and utilizing current software quality metric techniques for a software procurement associated with large scale software system developments. These procedures and guidelines encompass: How to identify and specify software quality requirements; How and when to apply software metrics; and How to interpret the information obtained from the application of the metrics. Author (GRA)

**N84-22278#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**GRID-BASED LINE DRAWING QUANTIZATION M.S. Thesis**
E. R. Christensen Dec. 1983 131 p
(AD-A138503; AFIT/GE/EE/83D-16) Avail: NTIS HC A07/MF A01 CSCL 09/2

This paper documents a quantitative analysis of the performance of the generalized chain codes when used to quantize sinusoids with specific periods and amplitudes. The analysis was performed using a software simulation of the various generalized chain codes using the triangular quantization scheme. The performance of the coding schemes was measured in terms of encoding rate and the area error in the quantization. Comparisons were made of the performance of the codes as the amplitude to period ratio was changed. Comparisons were made when the same codes were used to quantize the same sinusoids. An attempt was made to quantize a rotated sinusoid, however, the algorithm implemented was to inefficient with respect to computer processing time. Finally the effect of a capture region of 1/2 of the grid size on the performance of the codes was examined. GRA

**N84-22279#** California Univ., Livermore. Lawrence Livermore Lab.
**PICTURE: AN INTERACTIVE TOOL FOR CREATING VISUAL AIDS. REFERENCE MANUAL, VERSION 2.0**
Becky Springmeyer and Sara Bly 20 Jan. 1984 35 p
(Contract W-7405-eng-48)
(DE84-007447; UCID-19998) Avail: NTIS HC A03/MF A01

The PICTURE utility generates user defined pictures with black-and-white or color output, suitable for viewgraphs, slides, report diagrams - in general, any application requiring visual aids. The interactive menu-driven system allows a user to create a picture consisting of text, straight lines, graphs, and assortment of markers, splines and drawings, all in a variety of colors. Commands for manipulating the picture include moving, scaling, rotating, deleting, copying and changing the color of objects. Text strings may be aligned left, right, or centered, and have a vertical or horizontal path. Markers, circles and the large bold font may be filled or unfilled. The user may add or delete one of two overlay grids for help in positioning items. The final product may be saved in a text file for later retrieval. PICTURE currently runs on a VAX 11/780 with the DI-3000 commercial graphics package. Supported graphics devices include Ramtex 9400 and Metheus 440 frame buffers, and VT100s with Retrographics. DOE

**N84-22280#** Los Alamos Scientific Lab., N. Mex.
**HOW TO USE TRIX RED TO FORMAT EQUATIONS FOR REDPP AND OTHER TRICKS**
Kenneth A. VanRiper Dec. 1983 172 p
(Contract W-7405-eng-36)
(DE84-006328; LA-8792-M) Avail: NTIS HC A08/MF A01

This document is a compilation of methods learned while preparing a physics manual for a design code and simultaneously learning to use TRIX RED and REDPP. It is not meant to be an exhaustive survey of the possible uses of TRIX RED. The order of presentation follows the author's learning curve. Most of the errors encountered will be illustrated. An equation describing the jump in density across a hydrodynamic shock front is used to illustrate the techniques of formatting an equation. The formatting of various other mathematical constructs, such as integrals and summations, is also discussed. This document is intended as a supplement to the TRIX RED and REDPP manuals; it is hoped that concrete examples of both the right and wrong ways to do things will be useful. DOE

**N84-22281#** California Univ., Berkeley. Lawrence Berkeley Lab. Computer Science and Mathematics Dept.
**COMPUTER-ASSISTED INFORMATION GRAPHICS FROM THE GRAPHIC DESIGN PERSPECTIVE**
Aaron Marcus Nov. 1983 12 p refs Presented at the 1st Ann. Conf. of the Natl. Computer Graphics Assoc., Arlington, Va., 16-19 Jun. 1980
(Contract DE-AC03-76SF-00098)
(DE84-006059; LBL-11076; CONF-8006272-1) Avail: NTIS HC A02/MF A01

Computer-assisted information graphics can benefit by adopting some of the working processes, principles, and areas of concern typical of information-oriented graphic designers. A review of some basic design considerations is followed by a discussion of the creation and design of a prototype nonverbal narrative which combines symbols, charts, maps and diagrams. DOE

**N84-22282#** Utah Univ., Salt Lake City.
**REDIFLOW MULTIPROCESSING**
Robert Keller (LLNL), Frank C. H. Lin, and Jiro Tanaka Dec. 1983 10 p refs Presented at the IEEE Compcon Conference, San Francisco, 1 Mar. 1984
(Contract W-7405-eng-48)
(DE84-003194; UCRL-90069; CONF-840366-1) Avail: NTIS HC A02/MF A01

The concepts underlying Rediflow, a multiprocessing system being designed to support concurrent programming through a hybrid model of reduction, dataflow, and von Neumann processes are discussed. The techniques of automatic load-balancing in Rediflow are described in some detail. DOE

**N84-22283#** Logica Ltd., London (England).
**STATIC ANALYSIS PACKAGE Final Report**
D. K. Anker, I. G. Brownlie, M. D. Elkington, and C. D. Knight Paris ESA 19 Aug. 1983 51 p
(Contract ESTEC-4679/81/NL-PP)
(Rept-71.3794; ESA-CR(P)-1818) Avail: NTIS HC A04/MF A01

A Static Analysis Package (SAP) software quality assurance tool for FORTRAN programs was developed. It analyses source code and creates a data base of information to assist quality assessment, provide documentation, and determine test coverage. The SAP is portable, extendible, flexible, and user friendly. The package was designed in a top down fashion, performing a structured, stepwise decomposition from the requirements through design to the code. It was tested bottom up, from module tests through integration to acceptance. Author (ESA)

**N84-22284#** Politecnico di Milano (Italy). Dipt. di Elettronica.
**IMPLEMENTATION OF A STAND ALONE FORTRAN VERSION OF THE TOPSIM SIMULATION PACKAGE**
M. Elia, L. Lopresti, and M. Pent Paris ESA May 1983 90 p
(Contract ESTEC-4919/81/NL-PP(SC))
(ESA-CR(P)-1825) Avail: NTIS HC A05/MF A01

The TOPSIM 3 time domain communication systems simulation package is described. It runs on any computer with sufficient memory and a FORTRAN compiler. Language rules, architecture of a simulation program, organization of the simulation procedure, implementation of the TOPSIM processor and service library, and acceptance tests are outlined. Author (ESA)

**N84-22285#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group 10: Systems Research.
**PASCAL PACKAGES FOR ASC II FILE I/O AND CDC AND DYNAMIC STRINGS**
W. J. vandenEersten May 1983 47 p refs
(PhL-1983-18; TDCK-77992) Avail: NTIS HC A03/MF A01

Three packages, written in PASCAL, that implement dynamic strings and ASCII file I/O in a structured way on CDC Cyber computers are described. The package STRING implements dynamic strings and can also be used on machines other than the CDC Cyber. The package ASCII implements the ASCII file I/O. This package is constructed such that programs using it can easily be transported to PASCAL implementations that support ASCII file I/O. In order to be able to combine dynamic strings and ASCII file I/O on the CDC Cyber PASCAL implementation the package STRINGA is available. It is an adapted version of the package STRING. Author (ESA)

**N84-22286#** Karlsruhe Univ. (West Germany). Lehrstuhl fuer Prozessrechentechnik.
**SYSTEM FOR APPLICATION ORIENTED REQUIREMENT SPECIFICATION (SARS) Final Report, Dec. 1982**
Wolfgang Epple, Manfred Hagemann, Manfred Klump, and Guenter Koch (Biomatik GmbH) Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 154 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-DV-83-006; ISSN-0170-9011) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 32

Software requirements for process control systems are discussed. A system for application oriented requirement specification (SARS) was developed. A high degree of formalism was emphasized. The ARS-language (LARS) model fulfils most of the requirements for a pseudo-language to be used in requirement specification. Every requirement specification can be represented by the ARS-language by application oriented languages, which can be translated into LARS. The SARS is used in education to describe process control systems. Author (ESA)

**N84-22287#** National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
**FUNCTIONAL REQUIREMENTS FOR THE DEVELOPMENT AND USE OF A SOFTWARE-COST DATABASE**
G. J. Dekker and F. J. vandenBosch 28 Jan. 1983 35 p refs Submitted for publication
(Contract NIVR-1870)
(AD-B079998; NLR-MP-83009-U) Avail: NTIS HC A03/MF A01 CSCL 09/2

The characteristics of a data base used to develop an accurate cost estimation method and to support cost management in software development are discussed. A cost estimation method based on project size, project difficulty, reliability requirements, utilization, percentage of new design and code, development environment, application, and human resources, with 47 well-defined cost factors is proposed. Author (ESA)

**N84-22288#** Office of Software Development, Falls Church, Va. Federal Software Testing Center.
**VALIDATION REPORT IBM CORPORATION, IBM 5360 MODEL B24, SYSTEM/36 COBOL RELEASE 1 Summary Report**
21 Oct. 1983 53 p
(PB84-149228; OSD/FSTC-83/265) Avail: NTIS HC A04/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the IBM Corporation, SYSTEM/36 COBOL Release 1 (5727-CB1) running under the IBM SYSTEM/36 System Support Program Product Release 1 (5727-SS1) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated against the Low-Intermediate level of FIPS PUB 21-1. The VSR is made up of several sections showing all the discrepancies found -if any. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language, and a detailed listing of discrepancies together with the tests which failed. GRA

**N84-22289#** Rhode Island Univ., Kingston. Dept. of Computer Science and Experimental Statistics.
**DATMAN FORTRAN USER'S GUIDE VERSION 3.0**
L. J. Bass 1984 102 p
(Grant EPA-R-807031)
(PB84-149251; EPA-600/D-84-033; ERLN-X95) Avail: NTIS HC A06/MF A01 CSCL 09B

DATMAN is a data management system which runs on a variety of minicomputers. DATMAN has facilities for creating data bases, retrieving selected data from data in data bases, retrieving selected data from data bases and processing the retrieved data. Access through DATMAN is either through a terminal interface with which the user executes DATMAN directly or through a FORTRAN interface within which the user calls FORTRAN subroutines to access DATMAN data bases. The FORTRAN user interface is described. GRA

**N84-22290#** Office of Software Development, Falls Church, Va. Federal Software Testing Center.
**D AND B COMPUTING SERVICES, INC., AMDAHL 470 V/8, IBM FORTRAN VS RELEASE 3, MOD 0 Validation Summary Report**
21 Nov. 1983 13 p refs
(PB84-149327; OIT/FSTC-83/285) Avail: NTIS HC A02/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the D&B Computing Services, Inc., IBM VS FORTRAN Release 3 Mod 0 running under the VP/CSS Release CSS.304 provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1978 FORTRAN Standard (X3.9-1978/FIPS PUB 69). The compiler was validated against the Full Level FORTRAN level of FIPS PUB 69. The VSR is made up of several sections showing all the discrepancies found if any. These include an overview of the validation which lists all categories of discrepancies within X3.9-1978, and a detailed listing of discrepancies together with the tests which failed. GRA

**N84-22291#** Office of Software Development, Falls Church, Va. Federal Software Testing Center.
**DIGITAL EQUIPTMENT CORPORATION, VAX 11/730, VAX-11 BASIC V2.2 Validation Summary Report**
19 Dec. 1983 15 p refs
(PB84-149806; OIT/FSTC-83/336) Avail: NTIS HC A02/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the Digital Equipment Corporation, VAX-11 BASIC Compiler V2.2 running under the VAX/VMS V3.6 provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1978 BASIC Standard (X3.60-1978/FIP PUB 68). The compiler was validated against the Minimal BASIC level of FIPS PUB 68. The VSR is made up of several sections showing all the discrepancies found if any. These include an overview of the validation which lists all categories of discrepancies within X3.60-1978 and a detailed listing of discrepancies together with the tests which failed. GRA

**N84-22292#** Office of Software Development, Falls Church, Va.
**BURROUGHS CORPORATION, BURROUGHS B-7800, FORTRAN 77 VERSION III.4.1 Validation Summary Report**
7 Dec. 1983 15 p refs
(PB84-149913; OIT/FSTC-83/326) Avail: NTIS HC A02/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the Burroughs Corporation, Large Systems FORTRAN 77, VersionIII.4.1 running under the III.4.1 provides a consolidated summry of the results obtained from the validation of the subject compiler against the 1978 FORTRAN Standard (X3.9-1978/FIPS PUB 69. The com-

piler was validated against the Full Level FORTRAN level of FIPS PUB 69. The VSR is made up of several sections showing all the discrepancies found if any. These include an overview of the validation which lists all categories of discrepancies within X3.9-1978, and a detailed listing of discrepancies together with the test which failed. GRA

**N84-22293#** Office of Software Development, Falls Church, Va. Federal Software Testing Center.
**HONEYWELL INFORMATION SYSTEMS, DPS 6/96, COBOLA RELEASE 4.0 Validation Summary Report**
7 Oct. 1983 69 p refs
(PB84-150010; OSD/FSTC-83/260) Avail: NTIS HC A03/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the Honeywell Information Systems, COBOLA Relase 4.0 running under the GCOS6 MOD400 Release 3.0 provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The Compiler was validated against the High Level level of FIPS PUB 21-1. The VSR is made up of several sections showing all the discrepancies found if any. These include an overview of the validation which lists all categories of discrepancies by level/module within x3.23-1974, a section relating the categories of discrepancies to each of the Federal Levels of the language, and a detailed listing of discrepancies together with the tests which failed. GRA

**N84-22294#** Office of Software Development, Falls Church, Va. Federal Software Testing Center.
**IBM CORPORATION, IBM 5360 MODEL B24 SYSTEM/36 COBOL RELEASE 1**
21 Oct. 1983 14 p refs
(PB84-150226; OSD/FSTC-83/266) Avail: NTIS HC A02/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the IBM Corporation, SYSTEM/36 Release 1 (5727-CB1) running under the IBM SYSTEM/36 System Support Program Product Release 1 provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated against the Low-intermediate level of FIPS PUB 21-1. The VSR is made up of several sections showing all the discrepancies found if any. These include an overview of the validation which lists all categories of discrepancies by level/module within x3.23-1974, a section relating the categories of discrepancies to each of the Federal Levels of the language, and a detailed listing of discrepancies together with the tests which failed. GRA

**N84-22295#** United Nations Industrial Development Organization, Vienna (Austria).
**LICENSING COMPUTER SOFTWARE: BASIC CONSIDERATIONS AS TO PROTECTION AND LICENSING OF COMPUTER SOFTWARE AND ITS IMPLICATIONS FOR DEVELOPING COUNTRIES**
3 Nov. 1982 27 p refs Presented at 7th Meeting of Heads of Technol. Transfer Registries, New Delhi, 7-10 Dec. 1982
(PB84-150689; UNIDO/WG.383/3-Add-1) Avail: NTIS HC A03/MF A01 CSCL 09B

Definitions, overview of current patentability of computer software: USA, EEC, Japan; WIPO model provisions on the protection of computer software; protection of software in developing countries channels for transfer of software: custom software contracts; agreements for packaged software suggestions as to DCs approach toward licensing of software are covered. GRA

**N84-22296#** Office of Software Development, Falls Church, Va. Federal Software Testing Center.
**PRIME COMPUTER, INCORPORATED, PRIME 750, FORTRAN-77, REVISION 19.3.1 Validation Summary Report**
31 Dec. 1983 15 p refs
(PB84-151265; OIT/FSTC-83/311-Rev-19.3.1) Avail: NTIS HC A02/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the Prime Computer, Inc., FORTRAN-77 Revision 19.3.1 running under the PRIMOS Revision 19.2.3 provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1978 FORTRAN Standard (X3.9-1978/FIPS PUB 69). The compiler was validated against the Full Level FORTRAN level of FIPS PUB 69. The VSR is made up of several sections showing all the discrepancies found if any. These include an overview of the validation which lists all categories of discrepancies within X3.9-1978, and a detailed listing of discrepancies together with the tests which failed. GRA

**N84-22297#** Office of Software Development, Falls Church, Va. Federal Software Testing Center.
**DIGITAL EQUIPMENT CORPORATION, PDP-11/44, PDP-11 FORTRAN V5.0 Validation Summary Report**
19 Dec. 1984 12 p refs
(PB84-151273; OIT/FSTC-83/335) Avail: NTIS HC A02/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the Digital Equipment Corporation, PDP-11 FORTRAN V5.0 running under the RSX-11M-PLUS-2 V2.1 provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1978 FORTRAN Standard (X3.9-1978/FIPS PUB 69). The compiler was validated against the Subset FORTRAN level of FIPS PUB 69. The VSR is made up of several sections showing all the discrepancies found if any. These include an overview of the validation which lists all categories of discrepancies within X3.9-1978, and a detailed listing of discrepancies together with the tests which failed. GRA

**N84-22298#** Office of Software Development, Falls Church, Va. Federal Software Testing Center.
**VALIDATION REPORT: DIGITAL EQUIPMENT CORPORATION, VAX 11/780, PDP-11 FORTRAN V5.0 Summary Report**
19 Dec. 1984 15 p refs
(PB84-149236; OSD/FSTC-83/337) Avail: NTIS HC A02/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the Digital Equipment Corporation, PDP-11 FORTRAN V5.0 running under the VMS V3.4 provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1978 FORTRAN Standard (X3.9-1978/FIPS PUB 69). The compiler was validated against the Subset FORTRAN level of FIPS PUB 69. The VSR is made up of several sections showing all the discrepancies found if any. These include an overview of the validation which lists all categories of discrepancies within X3.9-1978, and a detailed listing of discrepancies together with the tests which failed. GRA

**N84-22180*#** Drexel Univ., Philadelphia, Pa. Dept. of Mathematical Sciences.
**AN OPERATOR CALCULUS FOR SURFACE AND VOLUME MODELING**
William J. Gordon *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 1-6 refs (For primary document see N84-22179 12-59)
(Contract N00014-80-C-0176)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22181*#** Structural Dynamics Research Corp., Milford, Ohio.
**A GEOMETRIC MODELER BASED ON A DUAL-GEOMETRY REPRESENTATION POLYHEDRA AND RATIONAL B-SPLINES**
Albert L. Klosterman *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 7-13 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22182*#** Fairchild Republic Div., Farmingdale, N. Y.
**THE COMPUTATION OF ALL PLANE/SURFACE INTERSECTIONS FOR CAD/CAM APPLICATIONS**
David H. Hoitsma, Jr. and Martin Roche (Lundy Electronics and Systems, Inc.) *In* NASA. Langley Research Center Computer-

Aided Geometry Modeling Mar. 1984 p 15-18 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22183*#** California Univ., Livermore. Lawrence Livermore Lab.
**USE OF SHAPE-PRESERVING INTERPOLATION METHODS IN SURFACE MODELING**
F. N. Fritsch (Drexel Univ.) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 19-24 refs (For primary document see N84-22179 12-59)
(Contract W-7405-eng-48)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22185*#** Cornell Univ., Ithaca, N.Y. Dept. of Structural Engineering.
**INTERSECTION OF PARAMETRIC SURFACES USING LOOKUP TABLES**
Samir L. Hanna, John F. Abel, and Donald P. Greenberg *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 37-49 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22187*#** Rochester Univ., N. Y. Office of Production Automation Project.
**SOLID MODELLING: HISTORY, STATUS AND CURRENT RESEARCH DIRECTIONS**
Herbert B. Voelcker *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 61-79 ref Sponsored in part by NSF (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22188*#** Sandia Labs., Albuquerque, N. Mex.
**SOLID MODELLING IN THE DEPARTMENT OF ENERGY**
D. R. Peterson *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 81-86 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22189*#** Texas Univ., Austin.
**VOLUMETRIC REPRESENTATION FOR OBJECT MODEL ACQUISITION**
W. N. Martin (Virginia Univ.), B. Gil, and J. K. Aggarwal *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 87-93 refs (For primary document see N84-22179 12-59)
(Grant AF-AFOSR-0064-82)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22190*#** Virginia Univ., Charlottesville. Dept. of Applied Mathematics.
**THE REPRESENTATION OF MANIPULABLE SOLID OBJECTS IN A RELATIONAL DATABASE**
Dennis Bahler *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 95-100 refs (For primary document see N84-22179 12-59)
(Contract NAG5-28209)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22191*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INTERACTIVE GEOMETRY MODELING OF SPACE STATION CONCEPTUAL DESIGNS Abstract Only**
Darlene D. DeRyder, Melvin J. Ferebee, Jr., and Mark L. McMillin *In its* Computer-Aided Geometry Modeling Mar. 1984 p 101-102 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22192*#** McDonnell-Douglas Automation Co., St. Louis, Mo.
**TRANSLATORS BETWEEN CADD AND SECTION 5 OF THE ANSI Y14.26M STANDARD**
R. F. Emnett, W. B. Gruttke, E. G. Houghton, and J. E. Oakes *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 103-117 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22193*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**AN INTERSECTION ALGORITHM FOR MOVING PARTS**
D. M. Esterling (George Washington Univ.) and J. VanRosendale *In its* Computer-Aided Geometry Modeling Mar. 1984 p 119-123 refs (For primary document see N84-22179 12-59)
(Contracts NCC1-36; NAS1-15810; NAS1-16394)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22194*#** Ecole Polytechnique, Montreal (Quebec).
**GENERATION OF SURFACE-FITTED COORDINATE GRIDS**
A. Garon and R. Camarero *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 125-138 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22195*#** Computer Sciences Corp., Hampton, Va.
**APPLICATION AND ENHANCEMENTS OF MOVIE.BYU**
Raymond L. Gates and William H. VonOfenheim *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 135-138 ref (For primary document see N84-22179 12-59)
(Contract NAS1-16078)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22196*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**DESKTOP COMPUTER GRAPHICS FOR RMS/PAYLOAD HANDLING FLIGHT DESIGN**
D. J. Homan *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 139-143 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22197*#** Princeton Univ., N. J.
**AUTOMATIC GENERATION OF 3-D ENVELOPES**
James Leavitt and Walter Mesdcher (Transportation Systems Center) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 145-149 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22198*#** Drexel Univ., Philadelphia, Pa. Analysis and Testing Group.
**ESCHER: AN INTERACTIVE MESH-GENERATING EDITOR FOR PREPARING FINITE-ELEMENT INPUT**
W. R. Oakes, Jr. *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 151-153 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22199*#** Computer Sciences Corp., Hampton, Va.
**THE SOLID MODEL GEOMETRY GENERATOR (SMGG)**
K. H. Jones, D. P. Randall, R. L. Gates, and W. H. VonOfenheim *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 155-164 (For primary document see N84-22179 12-59)
(Contract NAS1-16078)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22200*#** Polhemus Navigation Sciences, Inc., Essex Junction, Vt.
**THE 3SPACE DIGITIZER: A NEW INPUT DEVICE FOR SOLID GEOMETRY MODELING**
Jack Scully *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 165-168 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22201*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INTERACTIVE MODELING USING THE PATRAN-G PROGRAM**
Winifred A. Stalnaker *In its* Computer-Aided Geometry Modeling Mar. 1984 p 169-171 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22202*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INTERACTIVE GRAPHICS FOR QUICK-GEOMETRY MODELING**
James C. Townsend *In its* Computer-Aided Geometry Modeling Mar. 1984 p 173-180 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22205*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**THE TRIANGLE COMPARE METHOD OF HIDDEN-LINE ELIMINATION**
Charles R. Price *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 191-198 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22206*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**COMPUTER GRAPHICS IN AERODYNAMIC ANALYSIS**
J. V. Cozzolongo *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 199-207 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22207*#** Rensselaer Polytechnic Inst., Troy, N. Y. Center for Interactive Computer Graphics.
**INTERACTIVE GRAPHICS FOR GEOMETRY MODELING**
Michael J. Wozny *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 209-213 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22208*#** Cornell Univ., Ithaca, N.Y. Dept. of Structural Engineering.
**INTERACTIVE COMPUTER GRAPHIC SURFACE MODELING OF THREE-DIMENSIONAL SOLID DOMAINS FOR BOUNDARY ELEMENT ANALYSIS**
Renato Perucchio and Anthony R. Ingraffea *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 215-222 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22209*#** Washington Univ., Seattle. Dept. of Mechanical Engineering.
**INTERACTIVE WIRE-FRAME SHIP HULLFORM GENERATION AND DISPLAY**
D. E. Calkins, J. L. Garbini, and J. Ishimaru *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 223-234 ref (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22210*#** Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
**AN INTERACTIVE MODELING PROGRAM FOR THE GENERATION OF PLANAR POLYGONS FOR BOUNDARY TYPE SOLIDS REPRESENTATIONS OF WIRE FRAME MODELS**
Tulga Ozsoy and John B. Ochs *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 235-240 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22213*#** Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
**THE VIRTUAL FRONT END: TOWARDS BETTER MANAGEMENT OF SOLID GEOMETRIC DATA**
William W. Charlesworth and Michael J. Bailey *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 261-267 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22214*#** Tokyo Univ. (Japan). Dept. of Information Science.
**AN ENHANCED OCT-TREE DATA STRUCTURE AND OPERATIONS FOR SOLID MODELING**
K. Fujimura, H. Toriya (Ricoh Co., Ltd.), K. Yamaguchi, and T. L. Kunii *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 269-277 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22215*#** National Bureau of Standards, Washington, D.C.
**IGES, A KEY INTERFACE SPECIFICATION FOR CAD/CAM SYSTEMS INTEGRATION**
Bradford M. Smith and Joan Wellington *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 279-288 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22216*#** McDonnell-Douglas Automation Co., St. Louis, Mo.
**REFLECTIONS ON REPRESENTING NON-GEOMETRIC DATA**
R. F. Emnett and H. H. Shu (McDonnell Douglas Astronautics Co.) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 289-302 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22217*#** McDonnell-Douglas Automation Co., St. Louis, Mo.
**MODELING CONCEPTS FOR COMMUNICATION OF GEOMETRIC SHAPE DATA**
M. F. Collins (Control Data Corp.), R. F. Emnett, R. L. Magedson (Boeing Commercial Airplane Co.), and H. H. Shu (McDonnell Douglas Astronautics Co.) *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 303-318 ref (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22218*#** Utah Univ., Salt Lake City.
**COMPUTER-AIDED SURFACE REPRESENTATION AND DESIGN Abstract Only**
Robert E. Barnhill *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 319 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22219*#** Avco Lycoming Div., Stratford, Conn.
**PRESENT CAPABILITIES AND FUTURE REQUIREMENTS FOR COMPUTER-AIDED GEOMETRIC MODELING IN THE DESIGN AND MANUFACTURE OF GAS TURBINE**
E. Caille, M. Propen, and A. Hoffman *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 321-325 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22220*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**A COLLECTION OF PROCEDURES FOR DEFINING AIRPLANE SURFACES FOR INPUT TO PANAIR**
Ralph L. Carmichael *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 327-346 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22221*#** Boeing Commercial Airplane Co., Seattle, Wash.
**THE COMPUTATION OF MESH CONFIGURATIONS FOR THREE-DIMENSIONAL FLOW ANALYSIS**
S. G. Gibson *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 347-358 refs (For primary

document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22222*#** Lockheed-Georgia Co., Marietta.
**EVALUATION OF 3-D GRAPHICS SOFTWARE: A CASE STUDY**
M. E. Lores, S. H. Chasen, and J. M. Garner *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 359-376 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22223*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**USING A COMMERCIAL CAD SYSTEM FOR SIMULTANEOUS INPUT TO THEORETICAL AERODYNAMIC PROGRAMS AND WIND-TUNNEL MODEL CONSTRUCTION**
Francis Enomoto and Paul Keller *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 377-387 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

**N84-22225*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**GEOMETRIC MODELING OF LARGE SPACE ANTENNA DEPLOYMENT Abstract Only**
John Nazemetz (Oklahoma State Univ.), Karen Sage (Kentron International), Ray L. Gates (Computer Services Corp.), and Dariene D. DeRyder *In its* Computer-Aided Geometry Modeling Mar. 1984 p 399 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 09B

# 62 COMPUTER SYSTEMS

Includes computer networks.

**N84-22299*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**IPAD 2: ADVANCES IN DISTRIBUTED DATA BASE MANAGEMENT FOR CAD/CAM**
Susan W. Bostic. comp. Washington Apr. 1984 258 p refs Symp. held in Denver, 17-19 Apr. 1984; sponsored by NASA, Naval Material Command and the Industrial Technical Advisory Board
(NASA-CP-2301; L-15765; NAS 1.55:2301) Avail: NTIS HC A12/MF A01 CSCL 09B

The Integrated Programs for Aerospace-Vehicle Design (IPAD) Project objective is to improve engineering productivity through better use of computer-aided design and manufacturing (CAD/CAM) technology. The focus is on development of technology and associated software for integrated company-wide management of engineering information. The objectives of this conference are as follows: to provide a greater awareness of the critical need by U.S. industry for advancements in distributed CAD/CAM data management capability; to present industry experiences and current and planned research in distributed data base management; and to summarize IPAD data management contributions and their impact on U.S. industry and computer hardware and software vendors. For individual titles, see N84-22300 through N84-22318.

**N84-22300*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**MANAGEMENT OF CAD/CAM INFORMATION: KEY TO IMPROVED MANUFACTURING PRODUCTIVITY**
Robert E. Fulton and Jack Brainin (Naval Ship Research and Development Center) *In its* IPAD 2: Apr. 1984 p 1-24 refs (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

A key element to improved industry productivity is effective management of CAD/CAM information. To stimulate advancements in this area, a joint NASA/Navy/Industry project designated Integrated Programs for Aerospace-Vehicle Design (IPAD) is underway with the goal of raising aerospace industry productivity through advancement of technology to integrate and manage information involved in the design and manufacturing process. The project complements traditional NASA/DOD research to develop aerospace design technology and the Air Force's Integrated Computer-Aided Manufacturing (ICAM) program to advance CAM technology. IPAD research is guided by an Industry Technical Advisory Board (ITAB) composed of over 100 repesentatives from aerospace and computer companies. The IPAD accomplishments to date in development of requirements and prototype software for various levels of company-wide CAD/CAM data management are summarized and plans for development of technology for management of distributed CAD/CAM data and information required to control future knowledge-based CAD/CAM systems are discussed. Author

**N84-22301*#** Lockheed-Georgia Co., Marietta.
**CIM'S BRIDGE FROM CADD TO CAM: DATA MANAGEMENT REQUIREMENTS FOR MANUFACTURING ENGINEERING**
S. Jeane Ford *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 25-33 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

Manufacturing engineering represents the crossroads of technical data management in a Computer Integrated Manufacturing (CIM) environment. Process planning, numerical control programming and tool design are the key functions which translate information from as engineered to as assembled. In order to transition data from engineering to manufacturing, it is necessary to introduce a series of product interpretations which contain an interim introduction of technical parameters. The current automation of the product definition and the production process places manufacturing engineering in the center of CAD/CAM with the responsibility of communicating design data to the factory floor via a manufacturing model of the data. A close look at data management requirements for manufacturing engineering is necessary in order to establish the overall specifications for CADD output, CAM input, and CIM integration. The functions and issues associated with the orderly evolution of computer aided engineering and manufacturing are examined. Author

**N84-22302*#** Boeing Commercial Airplane Co., Seattle, Wash.
**TECHNOLOGY FOR THE PRODUCT AND PROCESS DATA BASE**
Robert D. Barnes *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 35-41 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

The computerized product and process data base is increasingly recognized to be the cornerstone component of an overall system aimed at the integrated automation of the industrial processes of a given company or enterprise. The technology needed to support these more effective computer integrated design and manufacturing methods, especially the concept of 3-D computer-sensible product definitions rather than engineering drawings, is not fully available and rationalized. Progress is being made, however, in bridging this technology gap with concentration on the modeling of sophisticated information and data structures, high-performance interactive user interfaces and comprehensive tools for managing the resulting computerized product definition and process data base. Author

**N84-22303*#** General Electric Co., Philadelphia, Pa.
**MATERIALS PROPERTIES DATA BASE COMPUTERIZATION**
R. G. Baur, M. L. Donthnier, M. C. Moran, I. Mortman, and R. S. Pinter *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 43-49 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

Material property data plays a key role in the design of jet engine components. Consistency, accuracy and efficient use of material property data is of prime importance to the engineering community. The system conception, development, implementation, and future plans for computer software that captures the Material Properties Handbook into a scientific data base are described. The engineering community is given access to raw data and property curves, display of multiple curves for material evaluation

and selection, direct access by design analysis computer programs, display of the material specification, and a historical repository for the material evolution. The impact of this activity includes significant productivity gains and cost reductions; all users have access to the same information nd provides consistent, rapid response to the needs of the engineering community. Future plans include incorporating the materials properties data base into a network environment to access information from other data bases and download information to engineering work stations. Author

**N84-22304*#** Boeing Commercial Airplane Co., Seattle, Wash.
**DESIGN VERSUS MANUFACTURING DATA BASE MANAGEMENT REQUIREMENTS**
E. G. McKenna *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 51-80 refs (For primary document see N84-22299 12-62)
(Contract NAS1-17555)
Avail: NTIS HC A12/MF A01 CSCL 09B

Data base management systems are valuable manufacturing and design tools as these disciplines are exceptionally information intensive, requiring precise organization and control of data processing and utilization. One such data base manager is the IPAD* system, which was originally developed to support the design process but was expanded to incorporate the additional needs of manufacturing. To set the stage, an overview of the design and manufacturing process is presented. The different functions of computers in these processes are then discussed. Finally, the design and manufacturing requirements for a data base manager are compared and contrasted. Author

**N84-22305*#** Boeing Computer Services, Inc., Seattle, Wash.
**A DISTRIBUTED DATA BASE MANAGEMENT FACILITY FOR THE CAD/CAM ENVIRONMENT**
R. M. Balza, R. W. Beaudet, and H. R. Johnson *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 81-96 refs (For primary document see N84-22299 12-62)
(Contract NAS1-17555)
Avail: NTIS HC A12/MF A01 CSCL 09B

Current/PAD research in the area of distributed data base management considers facilities for supporting CAD/CAM data management in a heterogeneous network of computers encompassing multiple data base managers supporting a variety of data models. These facilities include coordinated execution of multiple DBMSs to provide for administration of and access to data distributed across them. Author

**N84-22306*#** Boeing Computer Services, Inc., Seattle, Wash.
**DATA MANAGEMENT FOR COMPUTER-AIDED ENGINEERING (CAE)**
W. A. Bryant and M. R. Smith *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 97-108 refs (For primary document see N84-22299 12-62)
(Contract NAS1-17555)
Avail: NTIS HC A12/MF A01 CSCL 09B

Analysis of data flow through the design and manufacturing processes has established specific information management requirements and identified unique problems. The application of data management technology to the engineering/manufacturing environment addresses these problems. An overview of the IPAD prototype data base management system, representing a partial solution to these problems, is presented here. Author

**N84-22307*#** Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
**CAD/CAM AND SCIENTIFIC DATA MANAGEMENT AT DASSAULT**
Pierre Bohn *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 109-116 refs (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

The history of CAD/CAM and scientific data management at Dassault are presented. Emphasis is put on the targets of the now commercially available software CATIA. The links with scientific computations such as aerodynamics and structural analysis are presented. Comments are made on the principles followed within the company. The consequences of the approximative nature of scientific data are examined. Consequence of the new history function is mainly its protection against copy or alteration. Future plans at Dassault for scientific data appear to be in opposite directions compared to some general tendencies. Author

**N84-22308*#** Hewlett-Packard Co., Palo Alto, Calif. Information Management Lab.
**DISTRIBUTED DATA BASE SYSTEMS WITH SPECIAL EMPHASIS TOWARD POREL**
Erich J. Neuhold *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 117-136 refs (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

In the last few years a number of research and advanced development projects have resulted in distributed data base management prototypes. POREL, developed at the University of Stuttgart, is a multiuser, distributed, relational system developed for wide and local area networks of minicomputers and advanced micros. The general objectives of such data base systems and the architecture of POREL are discussed. In addition a comparison of some of the the existing distributed DMBS is included to provide the reader with information about the current state of the art. Author

**N84-22309*#** Control Data Corp., Minneapolis, Minn.
**CONTROL DATA ICEM: A VENDORS IPAD-LIKE SYSTEM**
Harley D. Feldman *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 137-138 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

The IPAD program's goal which was to integrate aerospace applications used in support of the engineering design process is discussed. It is still the key goal, and has evolved into a design centered around the use of data base management, networking, and global user executive technology. An integrated CAD/CAM system modeled in part after the IPAD program and containing elements of the program's goals was developed. The integrated computer aided engineering and manufacturing (ICEM) program started with the acquisition of AD-2000 and Synthavision. The AD-2000 has evolved to a production geometry creation and drafting system which is called CD/2000. Synthavision has grown to be a full scale 3-dimensional modeling system, the ICEM Modeler. E.A.K.

**N84-22310*#** Sperry Rand Corp., Blue Bell, Pa. Applications Development Center.
**FUTURE DEVELOPMENTS OF A HYBRID CAD/CAM SYSTEM**
J. Z. Gingerich *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 139-154 refs (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

The integration of proven CAD/CAM techniques with other system advances are presented. The Hybrid CAD/CAM System (UNIS*CAD) concepts and future developments and integration are addressed. E.A.K.

**N84-22311*#** Amoco Production Co., Tulsa, Okla. Research Center.
**RIM AS AN IMPLEMENTATION TOOL FOR A DISTRIBUTED HETEROGENEOUS DATABASE**
Yuri J. Breitbart and Larry R. Hartweg *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 155-164 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

The another distributed database system (ADDS) prototype supports interactive, d hoc retrieval from several of the Amoco/Standard DHDBMS. The ADDS conceptual design, the usage of RIM in several components of ADDS, and some enhancements ot RIM that were used by the developers of the ADDS prototype are outlined. Topics covered include: (1) ADDS Overview; (2) composite database dictionary/directory; (3) user interface and

user profiles; (4) subrequest execution; (5) merger/formatter; and (6) a transportable implamentation. E.A.K.

**N84-22312*#** Martin Marietta Aerospace, Denver, Colo.
**RIM AS THE DATA BASE MANAGEMENT SYSTEM FOR A MATERIAL PROPERTIES DATA BASE**
Patricia H. Karr and David J. Wilson *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 165-169 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

Relational Information Management (RIM) was selected as the data base management system for a prototype engineering materials data base. The data base provides a central repository for engineering material properties data, which facilitates their control. Numerous RIM capabilities are exploited to satisfy prototype data base requirements. Numerical, text, tabular, and graphical data and references are being stored for five material types. Data retrieval will be accomplished both interactively and through a FORTRAN interface. The experience gained in creating and exercising the prototype will be used in specifying requirements for a production system. E.A.K.

**N84-22313*#** General Dynamics Corp., Fort Worth, Tex.
**A WIND TUNNEL DATABASE USING RIM**
William O. Wray, Jr. *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 171-181 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

Engineering data base development which has become increasingly widespread to industry with the availability of data management systems is examined. A large data base was developed for wind tunnel data and related model test information, using RIM as the data base manager. The arrangement of the wind tunnel data into the proper schema for the most efficient database utilization is discussed. The FORTRAN interface program of RIM is used extensively in the loading phases of the data base and by the users. Several examples to illustrate how the Wind Tunnel Data base might be searched for specific data items and test information using RIM are presented. E.A.K.

**N84-22314*#** McDonnell-Douglas Corp., St. Louis, Mo.
**PRODUCT DEFINITION DATA INTERFACE**
Burt Birchfield and Peter Downey *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 183-210 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

The development and application of advanced Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) technology in aerospace industry is discussed. New CAD/CAM capabilities provide the engineer and production worker with tools to produce better products and significantly improve productivity. This technology is expanding in all phases of engineering and manufacturing with large potential for improvements in productivity. The integration of CAD and CAM systematically to insure maximum utility throughout the U.S. Aerospace Industry, its large community of supporting suppliers, and the Department of Defense aircraft overhaul and repair facilities is outlined. The need for a framework for exchange of digital product definition data, which serves the function of the conventional engineering drawing is emphasized. E.A.K.

**N84-22315*#** National Bureau of Standards, Washington, D.C. Center for Manufacturing Engineering.
**DATA DISTRIBUTION IN THE NBS AUTOMATED MANUFACTURING RESEACH FACILITY**
Mary J. Mitchell and Edward J. Barkmeyer *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 211-227 refs (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

The Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards was constructed as a testbed for research in the automation of small batch maufacturing, in particular for systems producing machined parts in lots of 1000 or less. Potential standard interfaces between existing and future components of small batch of factory floor metrology in an automated environment, delivering proven measurement techniques and standard reference materails industry to are identified. Commercially available product are used to construct the facility to expedite transfer of research results into the private sector. E.A.K.

**N84-22316*#** Missouri Univ., Rolla.
**THE DATABASE MANAGEMENT SYSTEM: A TOPIC AND A TOOL**
Otho R. Plummer *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 229-235 (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

Data structures and data base management systems are common tools employed to deal with the administrative information of a university. An understanding of these topics is needed by a much wider audience, ranging from those interested in computer aided design and manufacturing to those using microcomputers. These tools are becoming increasingly valuable to academic programs as they develop comprehensive computer support systems. The wide use of these tools relies upon the relational data model as a foundation. Experience with the use of the IPAD RIM5.0 program is described. E.A.K.

**N84-22317*#** Carnegie-Mellon Univ., Pittsburgh, Pa.
**THE ROLE OF DBMS IN DESIGN RESEARCH**
Steven J. Fenves *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 237-254 refs (For primary document see N84-22299 12-62)
(Grant NSF MCS-78-22328)
Avail: NTIS HC A12/MF A01 CSCL 09B

Research in integrated design systems which is almost invariable predicated on the existence of a data base that acts as a common repository of data representing the emerging specification of the system or artifact designed is discussed. The role of data base management systems (DBMS) in design reserch is outlined as follows: (1) the representation and processing of detailed constraints is presented, including a dynamic mechanism for activating cnstraints as a design is firmed up, (2) a concept of treating multiple sets of constraints as data residing in the data base is presented; (3) exploratory work on the interaction of DBMS with knowledge based expert design systems is given. E.A.K.

**N84-22318*#** Military Academy, West Point, N. Y.
**IMPACT OF IPAD ON CAD/CAM DATABASE UNIVERSITY RESEARCH**
Lanse M. Leach and Michael J. Wozny (Rensselaer Polytechnic Inst.) *In* NASA. Langley Research Center IPAD 2: Apr. 1984 p 255-257 refs (For primary document see N84-22299 12-62)
Avail: NTIS HC A12/MF A01 CSCL 09B

IPAD program has provided direction, focus and software products which impacted on CAD/CAM data base research and follow-on research. The relationship of IPAD to the research projects which involve the storage of geometric data in common data ase facilities such as data base machines, the exchange of data between heterogeneous data bases, the development of IGES processors, the migration of lrge CAD/CAM data base management systems to noncompatible hosts, and the value of RIM as a research tool is described. E.A.K.

**N84-22319#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**CONTINUED DEVELOPMENT OF A UNIVERSAL NETWORK INTERFACE DEVICE USING THE INTEL 8086 AND 8089 16-BIT MICROPROCESSORS M.S. Thesis**
W. F. Matheson 15 Dec. 1983 156 p
(AD-A138118; AFIT/GE/EE/83D-42) Avail: NTIS HC A08/MF A01 CSCL 09/2

This research describes the development of a Universal Network Interface Device (UNID II) which is intended to function as a node in a computer communications network. The UNID II is a 16-bit, 8086 microprocessor based version of the present 8-bit

Z80A UNID being developed at the Air Force Institute of Technology (AFIT). The UNID II's architecture was based on a conceptual block diagram design presented in a previous AFIT thesis. It is comprised of two modules: a local module, which interfaces the UNID II to host computers and/or peripheral devices; and a network module, which interfaces the UNID II to a computer communications network. In this report the detailed design of the network module, and the construction and testing of the local module is documented. The network module was designed using a pair of 8089 Input/Output Processors in a remote configuration. The local module consists of an Intel SBC 86/12A single board computer and a wire wrap card with four low speed I/O ports. Testing was done using an Intel ICE-86A/88A In-Circuit Emulator. The tests conducted, verified the proper operation of the local module, including some software to process X.25 formatted frames. The UNID II was not tested in a computer communications network environment. Author (GRA)

**N84-22320#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**PROTOCOL STANDARDS AND IMPLEMENTATION WITHIN THE DIGITAL ENGINEERING LABORATORY COMPUTER NETWORK (DELNET) USING THE UNIVERSAL NETWORK INTERFACE DEVICE (UNID), PART 1 M.S. Thesis**

P. W. Phister, Jr. Dec. 1983 642 p
(AD-A138481; AFIT/GE/EE/83D-58-Pt-1) Avail: NTIS HC A99/MF A01 CSCL 17/2

Development of the Air Force Institute of Technology's Digital Engineering Laboratory Network (DELNET) was continued with the development of an initial draft of a protocol standard for all seven layers as specified by the International Standards Organization's (ISO) Reference Model for Open Systems Interconnections. This effort centered on the restructuring of the Network Layer to perform Datagram routing and to conform to the developed protocol standards and actual software module development of the upper four protocol layers residing within the DELNET Monitor (Zilog MCZ 1/25 Computer System). Within the guidelines of the ISO Reference Model the Transport Layer was developed utilizing the Internet Header Format (IHF) combined with the Transport Control Protocol (TCP) to create a 128-byte Datagram. Also a limited Application Layer was created to pass the Gettysburg Address through the DELNET. This study formulated a first draft for the DELNET Protocol Standard and designed, implemented, and tested the Network, Transport, and Application Layers to conform to these protocol standards. Author (GRA)

# 63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

**N84-22321#** Purdue Univ., Lafayette, Ind.

**VARIABLE STRUCTURE CONTROL OF INTERCONNECTED SYSTEMS WITH APPLICATIONS TO POWER SYSTEMS**

Feb. 1983 148 p refs
(Contract DE-AC01-79ET-29365)
(DE84-006587; DOE/ER-29365/3) Avail: NTIS HC A07/MF A01

The theory and application of variable structure control for composite and interconnected nonlinear system models are described. Variable structure control is a generalized bang-bang control theory. Structurally the gain of each feedback path is switched between two possible gains. The gain setting depends on the position of the system state trajectory with respect to a set of switching surfaces. The viability and effectiveness of variable structure control for nonlinear systems is demonstrated. The basic theory of variable structure control for a composite single input system in a nonlinear controllable canonical form is surveyed and this development to the multiinput case is extended. The problem of decentralized variable structure control is examined and applied to an interconnected two pendulum system. A multiinput to a single machine infinite bus system is applied and a decentralized dither control for a two machine system is outlined. DOE

**N84-22322#** Oxford Univ. (England). Dept. of Engineering Science.

**REPRESENTATIONS OF UNCERTAINTY AND ROBUSTNESS**

Ian Postlethwaite and Yung Kuan Foo 1983 18 p refs
(OUEL-1489/83) Avail: NTIS HC A02/MF A01

Uncertainty in a control system, represented by a set of perturbed plant models in the neighborhood of a nominal model, is discussed as a means of assessing feedback design stability robustness. For nonsquare plants, not all the perturbation sets are adequate for representing unstructured uncertainty. Author (ESA)

**N84-22323#** Oxford Univ. (England). Dept. of Engineering Science.

**ADEQUATE/INADEQUATE REPRESENTATIONS OF UNCERTAINTY AND THEIR IMPLICATIONS FOR ROBUSTNESS ANALYSIS**

Yung Kuan Foo and Ian Postlethwaite 1983 32 p refs
(OUEL-1498/83) Avail: NTIS HC A03/MF A01

The adequacy of the most commonly used representations of uncertainty in control systems is discussed. The reliability of multiloop gain and phase margins as measures of relative stability is studied. It is argued that the margins are generally insufficient to guarantee a robust stability property and it is demonstrated how an optimal linear quadratic state feedback (LQSF) regulator can have comparatively poor margins at the plant output. By reintroducing Patel's measure of robustness it is shown that the robustness of the stability property of an optimal LQSF regulator may be made arbitrarily poor, even when the diagonal R criterion is satisfied; or infinite, providing the plant has as many inputs as states. Author (ESA)

**N84-22324#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Traffic Behavior Group.

**OPTIMAL CONTROL MODEL APPLICATIONS AND FIELD MEASUREMENTS WITH RESPECT TO CAR DRIVING**

G. J. Blaauw, J. Godthelp, and P. Milgram Oct. 1983 27 p refs
(IZF-1983-18; TDCK-78631) Avail: NTIS HC A03/MF A01

Two series of optimal control model predictions are stated for lateral position control in a straight driving scenario with disturbances generated internally by the driver. The first predicts lateral position variations and the time that a driver's vision can be occluded during the observation and control of different combinations of lateral position, lateral speed, yaw rate, lateral acceleration and yaw acceleration. The second series concerns two extreme sets of display variables in relation to driving speed and driving experience. Model predictions for the observation and control of all display variables give occlusion times which correspond with data from instrumented car studies with experienced drivers. However, with exclusive observation and control of the lateral position cue, predicted occlusion times are less than found in experimental results of inexperienced drivers. It is suggested that inexperienced drivers are also controlling yaw rate and/or both acceleration cues. Author (ESA)

# 64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

**N84-22325#** Helsinki Univ. (Finland). Dept. of Mathematics.

**AN ALGORITHM FOR ADDITIVE REPRESENTATION OF POSITIVE INTEGERS Thesis**

Jukka Phko Suomalainen Tiedeakatemia 1983 58 p refs
(ISSN-0355-0087; ISBN-951-41-0468-4) Avail: NTIS HC A04/MF A01

The algorithm that characterizes the sequence of minimal elements and the related average values are presented. Elementary

methods are used to study the general properties of the algorithm and examine several special sequences. M.A.C.

**N84-22326*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**NUMERICAL MODELING OF D-MAPPINGS WITH APPLICATIONS TO CHEMICAL KINETICS**
S. K. Dey Mar. 1984 8 p refs
(NASA-TM-84332; A-9256; NAS 1.15:84332) Avail: NTIS HC A02/MF A01 CSCL 12A

Numerical modeling of D-mappings was studied and applied to solving nonlinear stiff systems. These mappings were locally linearized for convergence analysis, and some applications were made to chemical kinetics. The technique avoids using multistep implicit codes that require inversion of Jacobian matrices, but depends on the Jacobians for its convergence analysis. M.A.C.

**N84-22327*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**ON THE GRID GENERATION METHODS IN HARMONIC MAPPING ON PLANE AND CURVED SURFACES Final Report**
S. S. Sritharan and Philip W. Smith (Old Dominion Univ.) Mar. 1984 24 p refs
(Contract NAS1-17070)
(NASA-CR-172331; ICASE-84-12; NAS 1.26:172331) Avail: NTIS HC A02/MF A01 CSCL 12A

Harmonic grid generation methods for multiply connected plane regions and regions on curved surfaces are discussed. In particular, using a general formulation on an analytic Riemannian manifold, it is proved that these mappings are globally one-to-one and onto. Author

**N84-22328*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**APPLICATION OF A FRACTIONAL-STEP METHOD TO INCOMPRESSIBLE NAVIER-STOKES EQUATION**
J. Kim and P. Moin Mar. 1984 35 p refs
(NASA-TM-85898; A-9665; NAS 1.15:85898) Avail: NTIS HC A03/MF A01 CSCL 12A

A numerical method for computing three dimensional, time dependent incompressible flows is presented. The method is based on a fractional step, or time-splitting, scheme in conjunction with the approximate-factorization technique. The use of velocity boundary conditions for the intermediate velocity field leads to inconsistent numerical solutions. Appropriate boundary conditions for the intermediate velocity field are derived and tested. Numerical solutions for flow inside a driven cavity and over a backward-facing step are presented and compared with experimenal data and other numerical results. Author

**N84-22329#** Wisconsin Univ., Madison. Mathematics Research Center.
**SOME CONSIDERATIONS IN ESTIMATING DATA TRANSFORMATIONS Technical Summary Report**
George E. P. Box and Conrad A. Fung (DuPont de Nemours (E.I.), Wilmington, Del.) Dec. 1983 20 p
(Contract DAAG29-80-C-0041)
(AD-A137960; MRC-TSR-2609) Avail: NTIS HC A02/MF A01 CSCL 12/1

In a recent paper Bickel and Doksum claimed that procedures proposed by Box and Cox for estimating a transformation can be costly and unstable. This document considers how the supposed cost and instability arise and illustrate the authors' points by further analysis of textile data from the original paper. The analysis is used to make the further point that the cost of not making a transformation, when such is appropriate, can be extremely high. Some common sense advice on transformation analysis is given. Author (GRA)

**N84-22330#** Texas Univ., Austin. Center for Cybernetic Studies.
**THE EXTREME POINT CHARACTERIZATIONS OF SEMI-INFINITE DUAL NON-ARCHIMEDEAN BALLS**
A. Charnes and T. Song Mar. 1983 22 p
(Contracts N00014-82-K-0295; MDA903-83-K-0312)
(AD-A138016; CCS-RR-449) Avail: NTIS HC A02/MF A01 CSCL 12/1

The extreme point characterization of the (l')-ball of a generalized finite sequence space by Kortanek and Strojwas was accomplished only for real scalars and by continuity considerations. This document shows that no topology of continuity is needed as in Kortanek-Strojwas and that the characterization extends to weighted (l')-balls with any ordered scalar field. A Chebyshev ball theorem is shown to be false since it has no extreme points. Via generalizing the LIEP, (Linear Independence with Extreme Points) theorem, useful projections of the ball are proved convex hulls of their extreme points. Author (GRA)

**N84-22331#** Wisconsin Univ., Madison. Mathematics Research Center.
**A BOUNDARY MODULUS OF CONTINUITY FOR A CLASS OF SINGULAR PARABOLIC EQUATIONS Technical Summary Report**
E E. DiBenedetto (Indiana Univ., Bloomington) Jan. 1984 12049 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-83-00293)
(AD-A138019; MRC-TSR-2623) Avail: NTIS HC A03/MF A01 CSCL 12/1

Parabolic equations describing diffusion phenomena with change of phase are considered. It is demonstrated that weak solutions are continuous up to the parabolic boundary of the domain of definition. The continuity is quantitatively described by a modulus determined a priori only in terms of the data. Author (GRA)

**N84-22332#** Wisconsin Univ., Madison. Mathematics Research Center.
**DEVELOPMENTS IN THE THEORY OF NONLINEAR FIRST-ORDER PARTIAL DIFFERENTIAL EQUATIONS Technical Summary Report**
M. G. Crandall and P. E. Souganidis Dec. 1983 24 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-80-02946)
(AD-A138020; MRC-TSR-2617) Avail: NTIS HC A02/MF A01 CSCL 12/1

The theory of scalar first-order fully nonlinear partial differential equations has recently enjoyed a strong development. One major step was a proof by M. Crandall and P.-L. Lions of the uniqueness of certain generalized solutions-called viscosity solutions- of problems involving such equations with the scope to accommodate applications to, for example, differential games. Following this event there has been a continuous stream of work concerning the existence, approximation and representation of viscosity solutions of Hamilton-Jacobi equations as well as interaction of the theory of viscosity solutions and areas of application (primarily control theory and differential games), and refined uniqueness results. This survey paper, which corresponds to an invited address by the first author at an international symposium on differential equations held in March 1983 at the University of Alabama-Birmingham, introduces the relevant concepts and describes the major results up to, roughly, July 1983. Author (GRA)

**N84-22333#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PARAMETER ESTIMATION FOR THE FOUR PARAMETER BETA DISTRIBUTION M.S. Thesis**
B. R. Treat Dec. 1983 141 p
(AD-A138062; AFIT/GOR/ENC/83D-6) Avail: NTIS HC A07/MF A01 CSCL 12/1

This investigation compared six estimation methods for the parameters of the four parameters Beta distribution. The methods used are the full four-moments estimator, four modified moment estimators, and a modified maximum likelihood estimator. A closed form solution is derived for the full moment estimator which the author has been unable to find in the literature. The four modified moment estimators are each defined by two moment equations and two equations involving the first and last order statistics. The modified maximum likelihood estimate is defined using the

skewness and kurtosis indices to define the shape parameters and then solving for the maximum likelihood estimate of the location parameters, when it exists. GRA

**N84-22334#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**VARIANCE REDUCTION TECHNIQUES WITH APPLICATIONS M.S. Thesis**
M. R. Elhefny Dec. 1983 146 p
(AD-A138074; AFIT/GOR/MA/83D-2) Avail: NTIS HC A07/MF A01 CSCL 12/1

The objective of this study was to find out about, analyze and illustrate the characteristics of variance reduction techniques. Extensive literature review was done to identify the basic idea, theoretical foundation, procedure for implementation, fields of application, and other specific characteristics of each technique. Examples were given to show how to implement the commonly used techniques. Computer programs were written to perform those examples. Results are used to compare the efficiency of different techniques. Three studies in the fields of inventory, queuing and computer performance measurement are discussed where different variance reduction techniques were employed. Conclusions and recommendations are given. Author (GRA)

**N84-22335#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**INTEGRAL GREEN'S FUNCTION SOLUTIONS TO DIFFERENTIAL EQUATIONS M.S. Thesis**
W. H. Ameling 5 Dec. 1983 69 p
(AD-A138077; AFIT/GEP/PH/83D-1) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report is the result of the author's investigations into the numerical solution of ordinary and partial differential equations. Green's Functions were used to convert the differential equations into integral form. The method of finite differences is a common, well known method. The Method of Weighted Residuals was used as a third method of solution. The main purpose of this thesis was to compare the accuracy and advantages and disadvantages of the integral equation Green's Function method to the other methods. A second purpose was to add to the author's own knowledge on how to solve differential equations. This effort also served to strengthen his own abilities to write computer programs. He has tried to give enough details on his derivations and equations used in programming so that others could use these in solving their own problems with these methods. GRA

**N84-22336#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**APPLICATIONS OF MULTIVARIATE STATISTICAL TECHNIQUES FOR COMPUTER PERFORMANCE EVALUATION M.S. Thesis**
G. L. Brundidge Dec. 1983 197 p
(AD-A138268; AD-E950472; AFIT/GCS/EE/83D-4) Avail: NTIS HC A09/MF A01 CSCL 12/1

In many situations the computer performance evaluation (CPE) analyst has collected an abundance of computer system performance data from the target system's accounting files and software monitors. Traditionally, regression analysis provided the primary means of examining CPE data sets, with the emphasis being on modeling specific workload and performance parameters. Multivariate analysis techniques provide the analyst with additional analysis tools for the examination of relationships, dimension, and structure of large amounts of data. This study examines possible CPE applications for four multivariate analysis techniques: Canonical Correlation, Factor Analysis, Discriminant Analysis, and Cluster Analysis. Also included in the study was the use of ordinary least squares regression modeling and ridge regression modeling, to exemplify the traditional problems encountered with use of regression analysis. Depending on the performance evaluation requirements, one or more of the multivariate techniques or ridge regression could be used to perform a preliminary or supplementary CPE data analysis. Author (GRA)

**N84-22337#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**GENERALIZED INVERSES OF MATRICES AND ITS APPLICATIONS M.S. Thesis**
A. M. E. Doma Dec. 1983 124 p
(AD-A138274; AD-E950472; AFIT/GCS/MA/83D-1) Avail: NTIS HC A06/MF A01 CSCL 12/1

Theory and computation techniques of the various type of generalized inverses of matrices which have polynomial elements x, y, z ..., etc., are presented. A simple algorithm for computation of generalized inverses of a constant matrix is established, and then applied to the case of matrices having polynomial elements in several variables. Reduction of a matrix to its Smith form over the ring of polynomial elements in several variables is presented. A simple algorithm for investigation of the system $Ax = b$ in case of constant and nonconstant rank of A is presented. Application of generalized inverses to solve more general matrix equations such as Lyapunov and Riccati equations is studied. Author (GRA)

**N84-22338#** Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
**A 2-STEP BILINEAR FILTERING APPROXIMATION**
T. U. Halawani, R. R. Mohler, and W. J. Kolodziej Jan. 1984 37 p
(Contract N00014-81-K-0814)
(AD-A138350; OSU-ONR-TR-84-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new approximation technique to a certain class of nonlinear filtering (signal processing) problems is considered here. The method is based on an approximation of a nonlinear, partially observable system by a bilinear model with fully observable states. The filter development proceeds from the assumption that the unobservable states are conditionally Gaussian with respect to the observation initially. The method is shown to be promising for real-time communication and sonar applications as demonstrated by computer simulations. Moreover, some of the traditional techniques evolve as special cases of this methodology. Author (GRA)

**N84-22339#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**INVESTIGATION OF THE NUMERICAL METHOD OF MOMENTS FOR DIGITAL COMPUTER DETERMINATION OF GREEN'S FUNCTIONS M.S. Thesis**
R. E. Clapp Oct. 1983 79 p
(AD-A138374; AFIT/GEP/PH/83D-3) Avail: NTIS HC A05/MF A01 CSCL 12/1

The purpose of this report was to determine the feasibility of using the method of weighted residuals to obtain approximations to the discrete Green's function or an analog to it. The methods of Galerkin, collocation, and finite differences were programmed on a CDC 7600 computer in FORTRAN IV. The resulting program was used to generate the approximate functions for the one and two-dimensional Poisson's equation. The two-dimensional case was restricted to the methods of Galerkin and finite differences on a rectangular body. The approximate Green's functions and analogs were applied to a series of inhomogeneity terms to obtain the approximate solutions. The results were compared to the analytical values at points of interest. The average percent error of the approximate solutions is reported for each case as the number of interior nodes of the mesh was increased. The areas of consideration were: the rate of convergence of the approximate solutions toward the analytical solution, the amount of computer-time required to execute the methods, and the accuracy of the approximate solutions. The results of this study indicate that the Green's functions and analogs obtained are valid approximations to the discrete Green's function itself, with the restrictions that additional calculations may be required in the case of the Galerkin approximations and excessive computer-time may occur for high-accuracy approximations. The finite difference approximations were determined to be the best method to use. Author (GRA)

**N84-22340#** Pennsylvania State Univ., University Park.
**RANK-BASED INFERENCE FOR LINEAR MODELS: ASYMMETRIC ERRORS**
J. C. Aubuchon and T. P. Hettmansperger Feb. 1984 30 p Prepared in cooperation with Ohio State Univ., Columbus.
(Contract N00014-80-C-0741)
(AD-A138404; TR-48) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper robust, rank-based inference procedures are considered for general linear models with (possibly) asymmetric errors. Approximating standard errors of estimates and testing hypotheses about the model parameters require estimating a scaling functional, and an approach is developed which, unlike previous work, does not require symmetry of the underlying error distribution or replicates in the design matrix. Hence, important asymmetric models such as arise in life testing can now be handled. Further, it is shown that the asymptotic properties of the inference procedures hold with simpler conditions on the design matrix than previously required. In addition an estimate of the intercept is developed without requiring the assumption of a symmetric error distribution. Author (GRA)

**N84-22341#** Boston Univ., Mass. Dept. of Mathematics.
**LINEAR AND NONLINEAR FINITE ELEMENTS Final Report**
I. Fried Dec. 1983 191 p
(Contract N00014-76-C-0036)
(AD-A138468; BU-1-84) Avail: NTIS HC A09/MF A01 CSCL 12/1

A general procedure is presented for the setting up of the element tangent stiffness matrix and element gradient through the discrete sampling of the nonquadratic total potential energy. Computations are done for the plate, the bent rod, the cable, the rubber membrane, and the thin shell of revolution. Author (GRA)

**N84-22342#** University of Southern California, Los Angeles. Social Science Research Inst.
**EQUAL WEIGHTS, FLAT MAXIMA, AND TRIVIAL DECISIONS**
R. S. John, W. Edwards, D. VonWinterfeldt, and F. H. Barron Jun. 1980 28 p Prepared in cooperation with Kansas Univ., Lawrence
(Contract N00014-79-C-0038)
(AD-A138506; AD-F630004; SSRI-RR-80-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

Most predictions are intended as a basis for decision making. The point of this paper is that prediction and decision require different methods. Equal weights, while often useful for prediction, are less useful for decision making. The action options available in any decision problem fall into three classes: sure winners, sure losers, and contenders. Sure winners and sure losers are defined by dominance, accepting sure winners and rejecting sure losers is trivial. Good decision rules should discriminate well among contenders. In the familiar pick-1 decision problem, options on the Pareto frontier (i.e., undominated options) almost always show negative correlations among attributes. Such negative correlations make equal weights inappropriate. This paper extends that result to the case in which a decision maker must pick k options out of n. In this case, the set of sure winners is usually not empty. It develops general procedures for identifying the set of contenders, given the options, k, and n. This set is a generalized Pareto frontier, of which the traditional kind is a special case. Simulations show that attribute intercorrelations among contenders are substantially depressed and typically negative, even if the intercorrelations in the whole set are positive. Such negative correlations among contenders strongly question the usefulness of equal weights for decision making. GRA

**N84-22343#** California Univ., Livermore. Lawrence Livermore Lab.
**USE OF SHAPE-PRESERVING INTERPOLATION METHODS IN SURFACE MODELING**
F. N. Fritsch Mar. 1983 16 p refs Presented at the Symp. on Computer-Aided Geometry Modeling, Hampton, Va., 20-22 Apr. 1983
(Contract W-7405-eng-48)
(DE83-012708; UCRL-88951; CONF-830488-1) Avail: NTIS HC A02/MF A01

The interpolation methods necessary to completely determine the Equations of State (EOS) surface are explained. Bilinear interpolation, bicubic splines, and Piecewise Cubic Hermites (PCH) are discussed. Examples that utilize these techniques are included. DOE

**N84-22344#** Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
**STEP SIZES USED BY ONE-STEP CODES FOR ODES**
Lawrence F. Shampine Jan. 1984 27 p refs Sponsored in part by Manchester Univ. and Imperial College and NATO
(Contract DE-AC04-76DP-00789)
(DE84-006317; SAND-83-2606) Avail: NTIS HC A03/MF A01

The traditional theory of one step methods for the numerical solution of the initial value problem for a system of ordinary differential equations (ODEs) assumes that the step sizes are given. In contrast, the codes select the step sizes automatically. It is shown how to apply the traditional theory to describe what the more sophisticated codes actually do. Two measures of efficiency are being used by workers in the field without clearly distinguishing them. It is necessary to make this distinction because of its implications for important questions of implementation. DOE

**N84-22345#** Sandia Labs., Albuquerque, N. Mex. Applied Mathematics Div.
**STEP SIZE CONTROL IN ODE SOLVERS**
Herman A. Watts Jan. 1984 25 p refs
(Contract DE-AC04-76DP-00789)
(DE84-006391; SAND-83-2262) Avail: NTIS HC A02/MF A01

General purpose codes which solve the initial value problem for ordinary differential equations vary the step size in some way to produce an accurate solution efficiently. The standard approach is to use the locally optimal step size strategy. An enhancement of this formulation is discussed which leads to substantial savings on problems involving rapidly changing components. DOE

**N84-22346#** Technische Hochschule, Darmstadt (West Germany). Fachbereich Mathematik.
**GALERKIN'S METHOD AND STABILIZATION METHOD FOR VARIABLE TYPE EQUATIONS**
Nikolai A. Larkin Nov. 1983 19 p refs Submitted for publication
(Preprint-789) Avail: NTIS HC A02/MF A01

Variable nonlinear differential equations are analyzed. Existence and uniqueness theorems for generalized solutions of boundary value problems are proved for equations with weak nonlinearity. The theorem of existence of a generalized solution of a quasi linear equation is proved using a modified Galerkin method. The linearized equation of nonsteady transonic gas dynamics is solved. Author (ESA)

**N84-22073*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EMPIRICALLY DERIVED SECOND ORDER SCHEMES FOR THE ADVECTION EQUATIONS WITH MINIMUM DISSIPATION AND DISPERSION ERRORS**
L. L. Takacs *In its* Res. Rev., 1983 Jan. 1984 p 119-130 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 12A

**N84-22074*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ON THE EFFECT OF USING THE SHAPIRO FILTER TO SMOOTH WINDS ON A SPHERE**
L. L. Takacs and R. C. Balgovind *In its* Res. Rev., 1983 Jan. 1984 p 131-140 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 12A

**N84-22076*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**APPLICATION OF AUGMENTED-LAGRANGIAN METHODS IN METEOROLOGY: COMPARISON OF DIFFERENT CONJUGATE-GRADIENT CODES FOR LARGE-SCALE MINIMIZATION**
I. M. Navon *In its* Res. Rev., 1983 Jan. 1984 p 150-156 refs (For primary document see N84-22049 12-47)
Avail: NTIS HC A16/MF A01 CSCL 12A

**N84-22184*#** Control Data Corp., Minneapolis, Minn.
**AN URNFUL OF BLINDING FUNCTIONS**
R. N. Goldman *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 25-35 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 12A

**N84-22186*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SURFACE GRID GENERATION FOR WING-FUSELAGE BODIES**
R. E. Smith, R. A. Kudlinski, and J. I. Pitts *In its* Computer-Aided Geometry Modeling Mar. 1984 p 51-60 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 12A

**N84-22204*#** Utah Univ., Salt Lake City. Dept. of Computer Science.
**SOME MATHEMATICAL TOOLS FOR A MODELLER'S WORK-BENCH**
Elaine Cohen *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 185-190 refs (For primary document see N84-22179 12-59)
(Contracts DAAG29-81-K-0111; DAAG29-82-K-0176; N00014-82-K-0351; Grants NSF MCS-82-03692; NSF MCS-81-21750)
Avail: NTIS HC A17/MF A01 CSCL 12A

**N84-22224*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**MATHEMATICAL SYNTHESIZATION OF COMPLEX STRUCTURES**
L. Bernard Garrett *In its* Computer-Aided Geometry Modeling Mar. 1984 p 389-398 refs (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 12A

# 65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

**N84-22347** National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
**CALCULATIONS OF REPEATABILITY**
J. E. Burns Nov. 1983 12 p
(NPL-RS(EXT)-69; ISSN-0143-7143) Copyright. Avail: Issuing Activity

Calculating the standard deviation of successive dosimeter readings and the means of groups of readings is explained. Combining results to get a better estimate of repeatability when the groups of measurements are expected to have different values, e.g., in the calibration of a radiation dosimeter at a range of X-ray qualities, is outlined. Significance tests are described.
Author (ESA)

**N84-22348#** Wisconsin Univ., Madison. Mathematics Research Center.
**ON THE ASYMPTOTICS OF MAXIMUM LIKELIHOOD AND RELATED ESTIMATORS BASED ON TYPE 2 CENSORED DATA Technical Summary Report**
Gouri K. Bhattacharyya Dec. 1983 27 p
(Contracts DAAG29-80-C-0041; N00014-78-C-0722)
(AD-A137958; MRC-TSR-2616) Avail: NTIS HC A03/MF A01 CSCL 12/1

Some simple procedures are provided for establishing the asymptotic normality and uniform strong convergence of a class of functions that arise in the context of estimating parameters from a type II censored sample. These are used to streamline and strengthen the traditional treatment of the asymptotic theory of maximum likelihood estimators based on censored data. Further applications include the treatment of asymptotics of some modified maximum likelihood (MML) estimators. In particular, conditions are provided for the consistency and limiting normality of the MML estimators of Mehrotra and Nanda, and the asymptotic efficiencies of these estimators are evaluated. Author (GRA)

**N84-22349#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**ROBUST MINIMUM DISTANCE ESTIMATION OF THE 3 PARAMETER LOGNORMAL DISTRIBUTION M.S. Thesis**
Jim H. Keffer Dec. 1983 116 p
(AD-A138007; AFIT/GOR/MA/83D-3) Avail: NTIS HC A06/MF A01 CSCL 12/1

This thesis compares two modified maximum likelihood (ML) estimation techniques against three minimum distance (MD) estimation techniques in application to the three parameter lognormal distribution. The three parameter lognormal distribution has a location parameter (xi) and two other parameters associated with the mean (micron) and standard deviation (delta) of its parent normal population. The first modified ML technique uses linear interpolation on order statistics to estimate location while the second ML technique uses the first order statistic as the location estimate. The remaining two parameters are calculated by using the location estimate in their respective censored or uncensored ML equations and solving for the parameters. Three MD techniques are used: Kolmogrov Distance, Cramer-von Mises Statistic, and the Anderson-Darling Statistic. The MD techniques refine the location estimates which are then used in the ML equations of the other two parameters to obtain their refined estimates. Monte Carlo analysis is used to accomplish the comparison of estimation techniques. Three measures of effectiveness are used to facilitate comparisons: mean square error, relative efficiency, and the Cramer-von Mises Statistic. Comparisons of these effectiveness measures across all cases reveal a clear superiority of the MD techniques over the modified ML techniques. Author (GRA)

**N84-22350#** Air Force Academy, Colo.
**BAYESIAN RELIABILITY TEST PLANS FOR ONE-SHOT DEVICES Final Report**
B. B. Wood Sep. 1983 57 p
(AD-A138234; USAFA-TR-84-01) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report develops statistical reliability test plans for systems which are not continuously operating such as missiles, bombs, and fuzes. The test plans are Bayesian in the sense that existing test data may be used to reduce the sample sizes required for subsequent testing. The prior probability density function of reliability is based upon this objective existing test data and is used to derive expressions for both producer's and consumer's posterior risks. Tables are provided for the practicing reliability manager to use in designing subsequent tests to meet threshold values of producer's and consumer's posterior risks. Author (GRA)

**N84-22351#** Naval Postgraduate School, Monterey, Calif.
**TOP-DOWN STATISTICAL ESTIMATION ON A DATABASE**
N. C. Rowe Jan. 1984 26 p
(RR0-0001)
(AD-A138318; NPS52-84-001) Avail: NTIS HC A03/MF A01 CSCL 12/1

The size of data sets subjected to statistical analysis is increasing as computer technology develops. Quick estimates of statistics rather than exact values are becoming increasingly important to analysts. The author proposes a new technique for estimating statistics on a database, a top down alternative to the bottom up method of sampling. This approach precomputes a set of general purpose statistics on the data base, a database abstract, and then uses a large set of inference rules to make bounded estimates of other, arbitrary statistics requested by users. The

inference rules form a new example of an artificial intelligence expert system. There are several important advantages of this approach over sampling methods. Author (GRA)

**N84-22352#** Oregon State Univ., Corvallis. Dept. of Statistics.
**BAYES LEAST SQUARES LINEAR REGRESSION IS ASYMPTOTICALLY FULL BAYES: ESTIMATION OF SPECTRAL DENSITIES**
H. D. Brunk and R. R. Mohler Jan. 1984 35 p
(Contract N00014-81-K-0814)
(AD-A138351; OSU-ONR-TR-84-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

Bayes least squares linear (BLSL) estimators were introduced by Whittle and described explicitly and further developed by Hartigan. The method was applied to estimation of coefficients of orthogonal expansions of regression functions in another work. In this present paper it is noted that when many observations are available the BLSL method can be expected to yield substantially the same results as a full Bayesian treatment; and the method is illustrated in the context of estimation of spectral densities. In that context, the estimators suggested will appear rather ordinary. But they are not completely ad hoc: each comes with an interpretation. And, when large samples are available, the posterior distribution of the estimator at a fixed frequency is (approximately) normal, with easily calculated standard deviation. GRA

# 66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

**N84-22353*#** Kentron International, Inc., Hampton, Va.
**UPPER AND LOWER BOUNDS FOR SEMI-MARKOV RELIABILITY MODELS OF RECONFIGURABLE SYSTEMS**
Allan L. White Apr. 1984 25 p refs
(Contract NAS1-16000)
(NASA-CR-172340; NAS 1.26:172340) Avail: NTIS HC A02/MF A01 CSCL 12B

This paper determines the information required about system recovery to compute the reliability of a class of reconfigurable systems. Upper and lower bounds are derived for these systems. The class consists of those systems that satisfy five assumptions: the components fail independently at a low constant rate, fault occurrence and system reconfiguration are independent processes, the reliability model is semi-Markov, the recovery functions which describe system configuration have small means and variances, and the system is well designed. The bounds are easy to compute, and examples are included. Author

**N84-22354#** Florida Univ., Gainesville. Dept. of Electrical Engineering.
**CONTROL OF PARAMETER-DEPENDENT SYSTEMS, SPATIALLY-DISTRIBUTED SYSTEMS, AND SYSTEMS WITH DELAYS Final Report, 1 Sep. 1981 - 31 Aug. 1983**
E. W. Kamen Dec. 1983 10 p
(Contract DAAG29-81-K-0166)
(AD-A138036; ARO-18814.9-MA) Avail: NTIS HC A02/MF A01 CSCL 14/2

This research centered on the following four classes of generalized linear systems: (1) Linear continuous-time and discrete-time systems whose coefficients depend on (a priori) unknown parameters; (2) linear spatially-distributed continuous-time and discrete time systems; (3) linear continuous-time systems with commensurate or non-commensurate time delays; and (4) linear time-varying discrete-time systems. GRA

# 67 THEORETICAL MATHEMATICS

Includes topology and number theory.

**N84-22355#** Stanford Univ., Calif. System Optimization Lab.
**CAN LEONTIEF AND P-MATRICES BE RESCALED POSITIVE DEFINITE**
George B. Dantzig Nov. 1983 14 p refs
(Contracts DE-AT03-76ER-72018; DE-AM03-76SF-00326; N00014-75-C-0267; Grants NSF MCS-81-19774; NSF MCS-79-26009; NSF ECS-80-12974; NR Proj. 047-143)
(DE84-004802; SU-SOL-83-23) Avail: NTIS HC A02/MF A01

When a square matrix M is positive definite, all of its principal minors are positive. This result is well known for symmetric M but is also true for nonsymmetric M, where positive definite is defined to be X/sup T/MX $>$ 0 for all X not equal to. When M is nonsymmetric, the converse is no longer true: M can be a P matrix, i.e., have all positive principal minors, but not be positive definite. Since a P-matrix under positive rescaling of its rows and columns is still a P-matrix, the question is asked: Under what conditions does there exist a rescaling of its rows and columns (which is equivalent to just its rows) that results in P.D. matrix, i.e., results in a positive definite matrix. The special case of Leontief matrices shows that these can always be rescaled positive definite. Because proofs of properties about P.D. matrices that appear in standard texts often assume M to be symmetric. These assuming nonsymmetry are reviewed before using them. For completeness, proofs of theorems of other authors used herein are also provided. DOE

# 70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

**N84-22356#** Joint Publications Research Service, Arlington, Va.
**EAST EUROPE REPORT: SCIENTIFIC AFFAIRS**
9 Apr. 1984 44 p refs Transl. into ENGLISH from various East European articles
(JPRS-ESA-84-010) Avail: NTIS HC A03/MF A01

Progress in research and development in East European countries is reported. Topics discussed include; computer literacy, fiber optics, microcomputer production, deep water submersibles, industrial technology, polar research, chemical research. For individual titles, see N84-22357 through N84-22358.

**N84-22357#** Joint Publications Research Service, Arlington, Va.
**CONCERTED EFFORT FOR NATIONWIDE COMPUTER LITERACY** c60
Gyorgy Paris *In its* East Europe Rept.: Sci. Affairs (JPRS-ESA-84-010) 9 Apr. 1984 p 1-8 Transl. into ENGLISH from Koznveveles (Budapest), 17 Feb. 1984 p 10-14 (For primary document see N84-22356 12-70)
Avail: NTIS HC A03/MF A01

Education in computer science and techniques is outlined. The advantages of computer technology and methods for effective use of the devices available are discussed. It is suggested that the teaching of computer technology must be organized effectively in public education, the teaching of informatics must be developed further in higher education, and computer technology information should be organized. Long range programs to organize this activity are examined. E.A.K.

**N84-22358#** Joint Publications Research Service, Arlington, Va.
**FIBER-OPTICS SYMPOSIUM, SCIENTIFIC AGREEMENT DESCRIBE** c74
Ryszard Romaniuk *In its* East Europe Rept.: Sci. Affairs (JPRS-ESA-84-010) 9 Apr. 1984 p 9-14 refs Transl. into ENGLISH from Nauka Polska (Warsaw), no. 3-4, Mar. - Apr. 1983 p 215-217 (For primary document see N84-22356 12-70)
Avail: NTIS HC A03/MF A01

Information on developments in fiber optics technology, especially production technology and fiber optics telecommunications, are obtained. The following topics were discussed: fiber optics in telecommunictions; fiber optics, technology, theory and

measurement; receiving fiber optics elements, couplings, connections, switches and pick-ups; integrated optical electronics; and applications of fiber optics technology in science, industry and biomedicine. E.A.K.

**N84-22359#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**INVESTIGATION OF SHEATH PHENOMENA IN ELECTRONEGATIVE GLOW DISCHARGES Ph.D. Thesis**
G. L. Duke Dec. 1983 230 p
(DA Proj. 230-1)
(AD-A138100; AFIT/DS/PH/83-6) Avail: NTIS HC A11/MF A01 CSCL 20/3

Two different methods of analyzing the cathode fall region of low pressure glow discharge were developed and applied to three different electronegative gas mixtures. One method was based on a self-consistent numerical solution to Poisson's equation, the current continuity equations for electrons and negative ions, and the current conservation equation. This method assumes the electrons are always in equilibrium with the electric field. The other method was based on a self-consistent numerical solution of the Boltzmann transport equation for electrons, Poisson's equations, and the current conservation equation. This method allows the electrons not be in equilibrium with the field. Comparing these two methods revealed that nonequilibrium prevails throughout the cathode fall region. The electronegative gas mixtures investigated were small concentrations (less than 10%) of hydrogen chloride in helium, argon, or xenon. GRA

**N84-22360#** Pittsburgh Univ., Pa. Dept. of Chemistry.
**STUDIES OF COERCIVE FORCE OF PERMANENT MAGNET MATERIALS Final Report, 1 Jan. - 31 Dec. 1983**
W. E. Wallace 31 Jan. 1984 14 p
(Contract DAAG29-83-K-0024)
(AD-A138123; ARO-19967.1-MS) Avail: NTIS HC A02/MF A01 CSCL 20/3

Permanent magnets were prepared by sintering on-stoichiometry Sm2Co17 and Sm2Co17 doped Fe,Mn,Zr and Hf. Coercive forces subscript i H subscript C were low, less than 1 kOe. Although doping increases anisotropy field, it does not enhance subscript i H subscript C except for Mn as dopant. In this case, doping increases subscript i H subscript C about two-fold. In these systems subscript i H subscript C seems to be nucleation-controlled. It is postulated that nucleation occurs at the oxidized surface where anisotropy is weak or negative. Surfaces were investigated by Auger spectroscopy with results consistent with the postulated mechanism. To test for effects of surface roughness, powders were washed with acid. No increase in subscript i H subscript C was observed. Samples ground under pentane and liquid nitrogen showed no significant difference in subscript i H subscript C. Oxygen content was about 3000 ppm by weight in the finished magnets. Results suggest that coercive force of the so-called 2-17 magnets (which are actually 2-phase mixtures of components with 1:5 and 2:17 stoichiometry, originates with the component having 1:5 stoichiometry. GRA

**N84-22361#** Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
**ELECTROMAGNETIC COUPLING BETWEEN A CONDUCTING BODY AND AN APERTURE IN AN INFINITE CONDUCTING PLANE**
S. W. Hsi, R. F. Harrington, and J. R. Mautz Dec. 1983 121 p
(Contract N00014-76-C-0225)
(AD-A138394; SYRU/DECE/TR-83/19; TR-22) Avail: NTIS HC A06/MF A01 CSCL 20/3

In this work, the problem of electromagnetic coupling between a conducting body and an aperture in an infinite conducting plane of zero thickness is considered. The method of moments is utilized to obtain a matrix formulation for the equivalent magnetic current in the aperture and the electric current on the conducting body. The general solution is then applied to problems for which the conducting body is a wire. The aperture is arbitrarily sized and shaped. The wire is of finite length (with or without loads) or of infinite length. Triangular patching is used to model the aperture. Local position vectors are chosen as the expansion functions in the aperture. Pulse functions are used as expansion functions for the current on the wire in the vicinity of the aperture, and two exponential wave functions are used as expansion functions for the transmission line mode on the wire. A Galerkin solution is used. Power transmitted through the aperture is evaluated. In addition, an equivalent circuit of the aperture for the transmission line mode on the loaded wire is derived. The numerical results show very good agreement with other available data. Author (GRA)

**N84-22362#** Nebraska Univ., Lincoln. Dept. of Physics and Astronomy.
**IMPROPER FERROELECTRICITY: A THEORETICAL AND EXPERIMENTAL INVESTIGATION Final Report, 15 Oct. 1976 - 15 Oct. 1983**
J. R. Hardy and F. G. Ullman 3 Feb. 1984 13 p
(Contract DAAG29-80-C-0034; Grant DAAG29-77-G-0008)
(AD-A138401; ARO-16620.8-PH; FR-1) Avail: NTIS HC A02/MF A01 CSCL 20/3

A combined theoretical and experimental study has been made of the origins and properties of the improper ferroelectricity associated with structural modulations of non-zero wavelengths. Two classes of materials have been studied: rare earth molybdates (specifically, gadolinium molybdate: GMO), and potassium selenate and its isomorphs. In the former, the modulation is produced by a zone boundary phonon instability, and in the latter by the instability of a phonon of wave vector approximately two-thirds of the way to the zone-boundary. In the second case the initial result is a modulated structure whose repeat distance is not a rational multiple of the basic lattice repeat distance. This result is a modulated polarization which, when the basic modulation locks in to a rational multiple of the lattice spacing, becomes uniform, and improper ferroelectricity results. The origins of these effects have been elucidated by theoretical studies, initially semi-empirical, but subsequently from first-principles. These complemented the experimental work, which primarily used inelastic light scattering, uniaxial stress, and hydrostatic pressure, to probe the balance between the interionic forces through the effects on the phonons and dielectric properties. GRA

# 71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution*.

**N84-22363*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**STUDY OF STATOR-VANE FLUCTUATING PRESSURES IN A TURBOFAN ENGINE FOR STATIC AND FLIGHT TESTS**
Arnold W. Mueller Apr. 1984 54 p refs
(NASA-TP-2217; L-15657; NAS 1.60:2217) Avail: NTIS HC A04/MF A01 CSCL 20A

As part of a program to study the fan noise generated from turbofan engines, fluctuating surface pressures induced by fan-rotor wakes were measured on core- and bypass-stator outlet guide vanes of a modified JT15D-1 engine. Tests were conducted with the engine operating on an outdoor test stand and in flight. The amplitudes of pressures measured at fan-rotor blade-passage fundamental frequencies were generally higher and appeared less stable for the static tests than for the flight tests. Fluctuating pressures measured at the blade-passage frequency of the high-speed core compressor were interpreted to be acoustic; however, disturbance trace velocities for either the convected rotor wakes or acoustic pressures were difficult to interpret because of the complex environment. M.G.

**N84-22364#** Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
**A REVERBERATION ROOM ROUND ROBIN ON THE DETERMINATION**

**OF ABSORPTION COEFFICIENTS**
U. Kath 1984 18 p refs Transl. into ENGLISH from Acustica (West Germany), v. 52, no. 4, 1983 p 211-215
(NRC/CNR-TT-2079; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

In ten reverberation rooms with very different volumes and different room shapes, the absorption coefficients for mineral fiber mat were measured. The particular feature of this round robin was that the absorption material was much thicker than in other similar experiments and that it was measured not only with an area of 12 sq m on the floor, but also as a complete surface covering of a small wall in order to avoid the edge effect. The decay curves were evaluated in at least two institutions and the absorption coefficients were calculated using the Eyring equation. The absorption coefficients were quite dispersed from one room to another and also from one-third octave band to the adjacent ones. Errors due to change are small, thus one is dealing with systematic errors. Author

**N84-22365*#** Cornell Univ., Ithaca, N.Y. School of Mechanical and Aerospace Engineering.
**BROADBAND ROTOR NOISE ANALYSES Final Report**
Albert R. George and Shau-Tak Chou Washington NASA Apr. 1984 98 p refs
(Grant NAG1-107)
(NASA-CR-3797; NAS 1.26:3797) Avail: NTIS HC A05/MF A01 CSCL 20A

The various mechanisms which generate broadband noise on a range of rotors studied include load fluctuations due to inflow turbulence, due to turbulent boundary layers passing the blades' trailing edges, and due to tip vortex formation. Existing analyses are used and extensions to them are developed to make more accurate predictions of rotor noise spectra and to determine which mechanisms are important in which circumstances. Calculations based on the various prediction methods in existing experiments were compared. The present analyses are adequate to predict the spectra from a wide variety of experiments on fans, full scale and model scale helicopter rotors, wind turbines, and propellers to within about 5 to 10 dB. Better knowledge of the inflow turbulence improves the accuracy of the predictions. Results indicate that inflow turbulence noise depends strongly on ambient conditions and dominates at low frequencies. Trailing edge noise and tip vortex noise are important at higher frequencies if inflow turbulence is weak. Boundary layer trailing edge noise, important, for large sized rotors, increases slowly with angle of attack but not as rapidly as tip vortex noise. A.R.H.

**N84-22366#** General Electric Co., Schenectady, N. Y. Corporate Research and Development.
**EMPLOYMENT OF ADAPTIVE LEARNING TECHNIQUES FOR THE DISCRIMINATION OF ACOUSTIC EMISSIONS Final Report, Nov. 1981 - Dec. 1982 on Phase 1**
Joseph W. Erkes, John F. McDonald, Henry A. Scarton, Kwok C. Tam, and Russell P. Kraft Nov. 1983 286 p
(Contract N00014-82-C-2031)
(AD-A138142; Doc-83SRD060) Avail: NTIS HC A13/MF A01 CSCL 20/1

The following aspects of this study on the discrimination of acoustic emissions (AE) were examined: (1) The analytical development and assessment of digital signal processing techniques for AE signal dereverberation, noise reduction, and source characterization; (2) The modeling and verification of some aspects of key selected techniques through a computer-based simulation; and (3) The study of signal propagation physics and their effect on received signal characteristics for relevant physical situations. GRA

**N84-22367#** Catholic Univ. of America, Washington, D.C. Dept. of Physics.
**ACOUSTIC EXPLORATION OF OCEAN FLOOR PROPERTIES BASED ON THE RINGING OF SEDIMENT LAYER RESONANCES Interim Technical Report, 1 Oct. 1982 - 30 Sep. 1983**
A. Nagl, H. Uberall, and K. B. Yoo 30 Nov. 1983 25 p
(Contract N00014-76-C-0430)
(AD-A138245) Avail: NTIS HC A02/MF A01 CSCL 20/1

It has recently been shown that the physical properties of a layered ocean floor may in principle be determined from an analysis of the resonances in frequency, or in the angle of incidence, which appear in bottom-reflected acoustic signals. In the present paper we demonstrate how, using sinusoidal signals of long but finite duration, individual resonances can be selectively excited and analyzed. Multiple-bounce layer resonances interfere destructive with the specular echo, and manifest themselves through a characteristic ringing. Author (GRA)

**N84-22368#** Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
**STUDIES TO IMPROVE ENVIRONMENTAL ASSESSMENTS OF SONIC BOOMS PRODUCED DURING AIR COMBAT MANEUVERING Final Report**
W. J. Galloway Wright-Patterson AFB, Ohio AMRL Oct. 1983 160 p
(Contract F33615-82-C-0501; AF Proj. 7231)
(AD-A138254; BBN-5322; AFAMRL-TR-83-078) Avail: NTIS HC A08/MF A01 CSCL 20/1

Fighter aircraft, when engaged in air-to-air combat training maneuvers where supersonic flight is permitted, produce sonic booms. Definition of the noise environment at locations on the ground below these maneuver areas must rely on statistical descriptions of aircraft operating parameters and geographic location. This report develops distribution functions for pertinent parameters for different fighter airplanes by analysis of tracking data obtained by Air Combat Maneuvering Instrumentation at supersonic military operating areas associated with Luke and Nellis Air Force Bases. Next a variety of pressure-time histories produced at ground microphone positions by sonic booms produced by an F-104 in a early NASA study were analyzed to obtain A-weighted and C-weighted sound levels. Particular attention was paid to the difference between peak unweighted overpressure, when expressed in decibels, and frequency-weighted sound exposure levels for sonic booms near a caustic produced by focusing during accelerated maneuvers, and as lateral cutoff conditions are approached. GRA

**N84-22369#** Georgetown Univ., Washington, D.C. Dept. of Physics.
**CHARACTERIZATION AND SCATTERING OF BOUNDED ULTRASONIC BEAMS Technical Report, 1 Jun. 1983 - 31 Jan. 1984**
T. D. K. Ngoc, W. G. Mayer, and T. H. Neighbors, III 16 Feb. 1984 17 p
(Contract N00014-78-C-0584)
(AD-A138491; GUUS-02847; TR-7) Avail: NTIS HC A02/MF A01 CSCL 20/1

The papers deal with some aspects of ultrasonic beam properties, their mathematical representation, and theoretical predictions related to reflection and scattering. The first paper deals with an acoustic-optic method by which the frequency contents of a pulsed ultrasonic signal can be determined without the introduction of a transducer probe whose presence in the path of the signal might alter the composition or shape of the pulse. The second paper is concerned with reflection of an ultrasonic signal at a boundary, particularly with the recently mentioned possibilities of the existence of backscattering. The third article deals with a method of describing mathematically a bounded beam which is known not to have a Gaussian cross section, and with the reflected profile of such a non-Gaussian beam. GRA

**N84-22370#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Afd. Audiologie.
**COMPARATIVE INVESTIGATION OF THE SOUND ATTENUATION OF FOUR TYPES OF FLYER HELMETS**
A. M. Mimpen Apr. 1983 11 p In DUTCH; ENGLISH summary
(Contract A76/K/104)
(IZF-1983-7; TDCK-77770) Avail: NTIS HC A02/MF A01

The sound attenuation as a function of frequency was determined for four models of flying helmet. The binaural perception threshold with and without helmet was measured. The flyer helmet SPH-4 gives the highest sound attenuation. The HGU-26 P type shows a significantly higher attenuation than the same helmet in a modified version. Helmet ILX-5 gives the lowest sound attenuation. Author (ESA)

**N84-22371#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Afd. Audiologie.
**ACTIVE SOUND REDUCTION SYSTEMS**
H. J. M. Steeneken May 1983 12 p refs In DUTCH; ENGLISH summary
(Contract A82/K/145)
(IZF-1983-8; TDCK-77951) Avail: NTIS HC A02/MF A01

Sound reduction systems to increase headset sound attenuation are discussed. Attenuation improvements up to 15 dB for frequencies below 500 Hz are obtained. At high noise levels, such as in tanks or helicopters, the risk of hearing damage is decreased. The signal to noise ratio of speech communication is decreased. A method for the subjective measurement of sound attenuation increase is proposed, and the possibility of developing an active sound reduction system is discussed. Author (ESA)

**N84-22372#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Afd. Audiologie.
**THE AUDIOMAT: AN AUTOMATIC AUDIOMETER TO BE USED IN OCCUPATIONAL AUDIOMETRY**
G. F. Smoorenburg, J. L. vanRaaij, and A. M. Mimpen Oct. 1983 52 p refs In DUTCH; ENGLISH summary
(Contract A78/K/072)
(IZF-1983-17; TDCK-78613) Avail: NTIS HC A04/MF A01

An automatic audiometer which runs fully automatically a customer tailored audiometric program using a microprocessor is described. It can be used as an independent unit, or it can be linked to an ITT 2020 microcomputer to control four audiomats simultaneously and asynchronously. The measurement procedure is based on the von Bekesy method optimized by research with test subjects and computer simulation. Two audiograms (left and right ears) based on 8 frequencies are measured within 8 min with an accuracy of 3dB. The audiomat is supplied with a transducer mounted in an earmuff, which makes it possible to measure thresholds in a not completely quiet environment. Author (ESA)

**N84-22373#** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Audiology Group.
**ANNOYANCE RATINGS FOR IMPULSE AND TRAFFIC SOUNDS PRESENTED IN QUIET SURROUNDINGS**
J. Vos and G. F. Smoorenburg Nov. 1983 13 p refs
(IZF-1983-23; TDCK-78681) Avail: NTIS HC A02/MF A01

In the laboratory, annoyance ratings for gunfire and traffic noise presented at indoor equivalent levels (Leq) of 35 to 56 dB(A) were determined. The gunfire noise was presented with quiet intervals in between the sound bursts. Background noise was not audible. Gunfire noise is rated more annoying than traffic noise. This difference increases with decreasing sound level. A penalty for impulse noise should be level dependent, ranging from 13.5 dB at an indoor Leq of 35 dB(A) to 4.4 dB at a Leq of 56 dB(A). Level dependence of the penalty for impulse noise, as derived from the annoyance ratings, is supported by data based on verbally labeled degrees of annoyance. Author (ESA)

**N84-22374#** Technische Physische Dienst TNO-TH, Delft (Netherlands). Afd. Geluid.
**MEASUREMENTS OF THE IMPULSE RESPONSE AND REVERBERATION UNDERWATER IN THE DEPRESSURIZED TOWING TANK MARIN**
A. deBruijn 21 Dec. 1982 27 p refs In DUTCH; ENGLISH summary
(Contract A82/KM/005)
(TPD-208.730/1; TDCK-78124) Avail: NTIS HC A03/MF A01

The underwater impulse response of a depressurized towing tank was determined. An electrodynamic underwater sound source generated a chirp consisting of a relatively long sinusoidal pressure signal with frequency modulation. By signal processing, the chirp was compressed to a short idealized pulse. The reflectograms obtained with the chirp are also converted to true impulse response data. For a number of positions in the tank, typical for the usual hydrophones, the impulse responses are calculated with the aid of a sound source at the propeller source line. From the echograms it can be seen that the bottom and side wall reflections are not significant in comparison with the direct signal. The impulse response data are used to calculate the reverberation curves by adopting Schroeder's concept of the integrated impulse response. From these curves it is concluded that for typical hydrophone distances to the cavitating propeller, i.e., 2 m, the direct sound radiated from the cavitating propellers is predominant in comparison with the reflected sound. Author (ESA)

**N84-22375#** Technische Physische Dienst TNO-TH, Delft (Netherlands). Afd. Geluid.
**THE MEASUREMENT OF MECHANICAL POINT ADMITTANCES BY MEANS OF HAMMER EXCITATION AND TAPE RECORDING. PART 1: A FEASIBILITY STUDY [HET METEN VAN MECHANISCHE PUNTADMITTANITIES MET BEHULP VAN HAMERAANSTOTING EN MAGNEETBANDREGISTRATIE. DEEL 1: EEN HAALBAARHEIDSONDERZOEK]**
J. G. vanBakel 18 May 1983 55 p refs In DUTCH; ENGLISH summary 2 Vol.
(Contract A80/KM/003)
(TPD-308.780/1-Vol-1; TDCK-78125) Avail: NTIS HC A04/MF A01

The feasibility of a measurement method to determine the point admittances in normal direction onboard ships using hammer excitation and tape recorders was studied. Measurements were performed in the laboratory on the steel hull of a water basin. The investigation was focussed on the limited range of tape recording, the phase reliability of the tape recorder, and the overload indication. The method is accurate and feasible for proper combinations of exciting hammer and structure, and for tape recording with extremely good phase reliability. Measurement of the real part of mechanical admittance is most sensitive to noise at very reactive admittances. These occur at frequencies below and near those of local resonances. At the same frequencies the measurements are sensitive to phase errors. Author (ESA)

**N84-22376#** Technische Physische Dienst TNO-TH, Delft (Netherlands). Afd. Geluid.
**THE MEASUREMENT OF MECHANICAL POINT ADMITTANCES BY MEANS OF HAMMER EXCITATION AND TAPE RECORDING. PART 2: MEASURING AND PROCESSING RULES [HET METEN VAN MECHANISCHE PUNTADMITTANTIES MET BEHULP VAN HAMERAANSTOTING EN MAGNEETBANDREGISTRATIE. DEEL 2: MEET EN VERWERKINGSVOORSCHRIFT]**
J. G. vanBakel 6 Jun. 1983 40 p refs In DUTCH; ENGLISH summary 2 Vol.
(Contract A80/KM/003)
(TPD-308.780/2-Vol-2; TDCK-78126) Avail: NTIS HC A03/MF A01

Measuring and data processing rules are drawn up for a measurement method to determine the point admittances in normal direction onboard ships using hammer excitation and tape recorders. Measuring equipment and computer programs are described. Author (ESA)

**N84-22377#** Technische Physische Dienst TNO-TH, Delft (Netherlands). Afd. Geluid.
**ON THE MEASUREMENT OF STRUCTURE-BORNE SOUND ENERGY FLOW ALONG PIPES. PART 3: ANALYSIS OF SYSTEMATIC AND RANDOM ERRORS**
J. W. Verheij and C. J. M. vanRuiten 8 Apr. 1983 46 p refs
(Contract A76/KM/030)
(TPD-308.785/1; TDCK-77849) Avail: NTIS HC A03/MF A01

Errors in methods based on finite difference approximations and using cross spectral densities of accelerations at closely

spaced pipe cross sections for measuring structure-borne energy flow in thin walled circular cylindrical pipes (by separating the contributions of longitudinal torsional and bending waves) are analyzed. A quantity called direct field ratio, that defines the ratio between the measured energy flow and the energy flow that would be measured in a free propagating wave under noise-free conditions is introduced. It indicates conditions where the estimates of the cross spectral density are sensitive to several error sources.
Author (ESA)

**N84-22378#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Technische Akustik.
**FIELD EVALUATION OF PROPOSED ICAO ANNEX 16 TAKEOFF NOISE CERTIFICATION PROCEDURE FOR PROPELLER-DRIVEN AIRPLANES NOT EXCEEDING 5700 KG**
Hanno Heller, Wolf Splettstoesser, Manfred Ahlswede, Klaus-Peter Anders, and Karl-Heinz Spiegel Sep. 1983 64 p refs
(DFVLR-FB-83-34) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 23

Five propeller driven airplanes with a takeoff mass ranging from 650 to 4375 kg were tested, using the Takeoff Noise Certification Procedure for Propeller-driven Aeroplanes not Exceeding 5700 kg proposed by the Alternative Certification Subgroup of the ICAO Committee on Aircraft Noise (CAN)/Working Group C. Field tests show the procedure to be entirely feasible, if more time-consuming than the conventional horizontal flyover noise certification test procedure. Utilizing available data, certification noise limits are proposed for noise-metrics Maximum A-weighted Level, and Sound Exposure Level. Author (ESA)

**N84-22379#** National Aerospace Lab., Amsterdam (Netherlands). Fluid dynamics Div.
**ACOUSTIC WAVE PROPAGATION THROUGH SHEAR LAYER OF THE GERMAN-DUTCH OPEN JET WIND TUNNEL (DNW)**
R. Ross, K. J. Young (Boeing Commercial Airplane Co.), R. M. Allen (Boeing Commercial Airplane Co.), and J. C. A. vanDitschuizen (German Dutch Wind Tunnel) 14 Jan. 1983 14 p refs Presented at the 8th AIAA Aero-acoustic Conf., Atlanta, 11-13 Apr. 1983
(NLR-MP-83003-U) Avail: NTIS HC A02/MF A01

The acoustic correction procedures for 1/3 octave analysis in a 20 m long open jet, surrounded by a large anechoic room, were checked with a calibrated noise source using noise data taken inside and outside the flow. Multitone marine horns and an acoustic driver coupled to a horn for broadband and single tone noise were used. The usual instrumentation and wind tunnel corrections can be applied. The usual shear layer correction, based on an infinitely thin shear layer, has to be extended to correct for turbulence and other effects for the case of high tunnel velocity, high frequency, and the most forward and the most rearward propagation angles from the sound source. This correction is insensitive to the position of the model in the flow and type of sound source (tone or broadband). Author (ESA)

# 72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

**N84-22380*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**A COMPARISON OF RADIATION DAMAGE IN LINER ICS FROM COBALT-60 GAMMA RAYS AND 2.2-MeV ELECTRONS**
Michael K. Gauthier and Donald K. Nichols 30 Sep. 1983 65 p refs
(Contract NAS7-100)
(NASA-CR-173474; JPL-Pub-83-78; NAS 1.26:173474) Avail: NTIS HC A04/MF A01 CSCL 18H

The total ionizing dose response of fourteen IC types from eight manufacturers was measured using Co-60 gamma rays and 2.2-MeV electrons for exposure levels of 100 to 20,000 Gy(Si). Key parameter measurements were made and compared for each device type. The data show that a Co-60 source is not a suitable simulation source for some systems because of the generally more damaging nature of electrons as well as the unpredictable nature of the individual device response to the two types of radiations used here. Author

**N84-22381#** Washington Univ., Seattle. Dept. of Chemistry.
**VIBRATIONAL ENERGY TRANSFER AT A SURFACE IN REACTING SYSTEMS. DECOMPOSITION OF AZOMETHANE**
W. Nilsson, E. Linkaityte-Weiss, and B. S. Rabinovitch 10 Jan. 1984 21 p
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A137966; TR-29) Avail: NTIS HC A02/MF A01 CSCL 07/4

Single collision activation of the energetic species azomethane at a hot seasoned fused silica surface was studied. Excitation above the critical threshold (E sub 0 approx. 50 kcal/mole) was monitored by subsequent homogeneous decomposition. The collisional efficiency was studied over the range 700K to 875K. Energy transfer efficiency is discussed and compared with values for other substrate molecules of comparable size and polarity. The data emphasize the uncertainty that still prevails with respect to the values of the Arrhenius parameters for this system.
Author (GRA)

**N84-22382#** Pittsburgh Univ., Pa.
**LABORATORY STUDIES OF ATOMIC COLLISION PROCESSES Final Report, 1 Sep. 1980 - 31 Oct. 1983**
M. A. Biondi and R. Johnsen 4 Jan. 1984 3 p
(Contract DAAG29-80-K-0081)
(AD-A137992; ARO-17343.3-PH) Avail: NTIS HC A02/MF A01 CSCL 07/4

The various electron production and removal and ion-molecule reactions investigated experimentally under the ARO grant are enumerated. Reports containing the detailed scientific progress of these studies are cited. In addition, a list of the journal articles describing the results of the experimental investigations together with appropriate citations, is given. Author (GRA)

**N84-22383#** Navy Underwater Sound Reference Lab., Orlando, Fla.
**MEASUREMENT OF HYDROACOUSTIC PARTICLE MOTION BY HOT-FILM ANEMOMETRY Interim Report**
Pieter S. Dubbleday 10 Feb. 1984 59 p
(RR0-1108)
(AD-A138015; NRL-MR-5223) Avail: NTIS HC A04/MF A01 CSCL 20/7

The parameter most often measured in acoustic fields is the pressure. Other scalar field variables, like the density or temperature, may be directly computed from the pressure fluctuations at one point. To determine the particle velocity vector, one needs to know the pressure in the neighborhood of a given point in order to derive the acceleration by numerically computing the gradient field of the pressure. One may measure the velocity field more directly by recording the effect of accelerators attached to a neutrally buoyant sphere that follows the particle motion more or less closely. Its sensitivity to velocity, therefore, will be inversely proportional to the frequency. Hot-film (or hot-wire) anemometry is based on the phenomenon that the heat transfer from an electrically heated film or wire is a function of the fluid motion past the sensor. It is extensively used in study of turbulence, where it is assumed that there is an exponential relation between heat flux and particle velocity, indicated as King's law. The importance of free convection implies a different mode of operation of the anemometer in horizontal or in vertical acoustic particle motion. In the first case the received frequency is twice that of the acoustic field, and the voltage is proportional to the square of the particle displacement. In the second case the frequency is equal to that of the field, and the voltage is linear in the particle displacement. The sensitivity and directional response may be increased by an imposed bias flow. This report describes the measurement of the anemometer output in horizontal and vertical particle motion for water and ethylene glycol. GRA

**N84-22384#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**DISCRETE ELEMENTS METHOD OF NEUTRAL PARTICLE TRANSPORT Doctoral Thesis**
K. A. Mathews Oct. 1983 135 p
(AD-A138060; AFIT/DS/PH/83-5) Avail: NTIS HC A07/MF A01 CSCL 18/11

A new discrete elements (LN) transport method is derived and compared to the discrete ordinates SN method, theoretically and by numerical experimentation. The discrete elements method is more accurate than discrete ordinates and strongly ameliorates ray effects for the practical problems studied. The discrete elements method is shown to be more cost effective in terms of execution time with comparable storage to attain the same accuracy, for a one-dimensional test case using linear characteristic spatial quadrature. In a two-dimensional test case, a vacuum duct in a shield, LN is more consistently convergent toward a Monte Carlo benchmark solution than SN, using step characteristic spatial quadrature. An analysis of the interaction of angular and spatial quadrature in xy-geometry indicates the desirability of using linear characteristic spatial quadrature with the LN method. The discrete elements method is based on discretizing the Boltzmann equation over a set of elements of angle. The zeroth and first angular moments of the directional flux, over each element, are estimated by numerical quadrature and yield a flux-weighted average streaming direction for the element. (Data for this estimation are fluxes in fixed directions calculated as in SN.) GRA

**N84-22385#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**POINTING AND TRACKING OF PARTICLE BEAMS M.S. Thesis**
W. L. Zicker Dec. 1983 145 p
(AD-A138311; AFIT/GE/EE/83-73) Avail: NTIS HC A07/MF A01 CSCL 12/1

A problem is considered to determine the feasibility of using a Multiple Model Adaptive Estimator (MMAE) based on space-time point process observations, as part of a control loop. The estimator tracks the centroid of a one-dimensional Gaussian-shaped source of individual photo-electron events. The centroid is assumed to move dynamically as a first order Guass-Markov process. Estimator performance for two implementations (using best half versus merge rationale for limiting the number of individual filters in the MMAE structure) is described in terms of steady-state root mean square error evaluated as a function of six important system parameters. Estimates of the beam centroid are used by a regulator based on a Linear system and Quadratic cost criteria to determine the effectiveness of the method. For tracking purposes, a real-world target and a Kalman filter are provided based on a first order Guass-Markov process model, and the controller is tested in this environment. Results indicate that the estimator provides a viable means of controlling the position of the centroid. Author (GRA)

**N84-22386#** Naval Research Lab., Washington, D. C. Plasma Theory Branch.
**ON THE CONVECTIVE PROPERTIES OF THE RESISTIVE HOSE INSTABILITY IN AN INTENSE RELATIVISTIC ELECTRON BEAM Interim Report**
Y. Y. Lau and M. Lampe 30 Dec. 1983 30 p
(ARPA Order 4395)
(AD-A137527; AD-E000560; NRL-MR-5236) Avail: NTIS HC A03/MF A01 CSCL 20/7

We examine the convective characteristics of the resistive hose instability of a charged particle beam propagating in weakly ionized gas. We use a model which includes a plasma return current and a constant rate of plasma electrical conductivity production by the beam. When the spread mass model is adopted, the hose instability is shown, in all cases, to be convective in the beam frame, with the amplifying disturbances propagating from the beam head toward the beam tail, regardless of the amount of return current. The minimum speed of propagation for the amplifying disturbance is typically 1/3 to 1/2 of the group velocity associated with the maximum amplification rate. The implications of this result are explored. GRA

**N84-22387#** Kentucky Univ., Lexington.
**RESEARCH IN THEORETICAL NUCLEAR PHYSICS Progress Report, 1 Aug. 1982 - 31 Jan. 1984**
Keh-Fei Liu 1984 9 p
(Contract DE-AS05-82ER-40074)
(DE84-006976; DOE/ER-40074/T1) Avail: NTIS HC A02/MF A01

The short range NN deformation potential is calculated in the MIT bag model with several corrections. The color van der Waals force is derived in the coupled channel formalism. The baryon spectrum is studied with the potentials fitted to meson masses. The production of multi-quark hadrons which decay to vector meson pairs are studied in (GAMMA)(GAMMA) reactions, hadronic collisions, J/psi radiative decays and reliativistic heavy ion collisions. The feasibility of (81)Br as a solar neutrino detector is studied by estimating the solar neutrino capture rate using information from the charge exchange reactions. Landau sum rules are applied to examine the Landau-Migdal parameters. An extended Skyrme-Landau interaction is being developed. Landau damping in the nuclear matter is being calculated. DOE

**N84-22388#** George Washington Univ., Washington, D.C.
**INVESTIGATIONS OF THE STRUCTURE AND ELECTROMAGNETIC INTERACTIONS OF FEW BODY SYSTEMS Annual Progress Report, 1 Sep. 1982 -31 aug. 1983**
E. P. Harper, D. R. Lehman, and F. Prats 1983 31 p refs
(Contract DE-AS05-79ER-10332)
(DE84-006852; DOE/ER-10332/T2) Avail: NTIS HC A03/MF A01

The structure and electromagnetic interactions of few-body systems were investigated. The structural properties of the very light nuclei are examined by developing theoretical models that begin from the basic interactions between the constituents and that are solved exactly (numerically), i.e., full three- or four-body dynamics. Such models are then used in an attempt to understand the details of the strong and electromagnetic interactions of the few-nucleon nuclei after the basic underlying reaction mechanisms are understood with simpler models. Topics included: (1) set up the equations for the low-energy photodisintegration of (3)He and (3)H including final-state interactions and the E1 plus E2 operators; (2) develop a unified picture of the p + d (YIELDS) (3)He + (GAMMA), p + d (YIELDS) (3)He + (PI) (0), p + d (YIELDS) (3)H + (PI) (+) reactions at intermediate energies; (3) calculate the elastic and inelastic (1(+) (YIELDS) 0 (+)) form factors for (6)Li with three-body ((ALPHA)NN) wave functions; (4) calculate static properties (RMS radius, magnetic moment, and quadrupole moment) of (6)Li with three-body wave functions; and (5) develop the theory for the coincidence reactions (6)Li(p,2p)n(ALPHA), (6)Li(e,e'p)n(ALPHA), and (6)Li(e,e'd)(ALPHA). DOE

**N84-22389#** Stanford Linear Accelerator Center, Calif.
**A 650 mm LONG LIQUID HYDROGEN TARGET FOR USE IN A HIGH INTENSITY ELECTRON BEAM**
John W. Mark Feb. 1984 4 p refs Presented at the Cryogenic Eng. Conf. and Intern. Cryogenic Mater. Conf., Colorado Springs, Colo., 11-19 Aug. 1983
(Contract DE-AC03-76SF-00515)
(DE84-007086; SU-SLAC-Pub-3169-Rev; CONF-830841-30) Avail: NTIS HC A02/MF A01

A 650 mm long liquid hydrogen target constructed for use in the high intensity electron beam of the linear accelerator is described. The main design problem was to construct a target that would permit the heat deposited by the electron beam to be removed rapidly without boiling the hydrogen so as to maintain constant target density for optimum data taking. Design requirements, construction details and operating experience are discussed. A hydrogen target system that could absorb up to 250 watts of beam power with flow parallel to the beam direction was produced. Liquid mixing transverse to the beam direction limited the local boiling in the beam spot to 7%. DOE

**N84-22390#** California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
**CHOICE OF IP GEOMETRY AND BEAM PARAMETERS FOR THE SSC**
Christoph Leemann Dec. 1983 12 p refs Presented at the Workshop on Accelerator Phys. Issues for a Superconducting Super Collider, Ann Arbor, Mich., 12-16 Dec. 1983
(Contract DE-AC03-76SF-00098)
(DE84-006610; LBL-17052; CONF-831264-5) Avail: NTIS HC A02/MF A01

Beams consisting of closely spaced bunches crossing at a small angle are the most promising solution. Bunched beams reach high luminosity with a moderate total charge in the machine while the close bunch spacing keeps the peak event rate low. The non-zero crossing angle is required to avoid unwanted collisions in the vicinity of each IP where the beams remain close. DOE

**N84-22391#** Stanford Linear Accelerator Center, Calif.
**SECOND ORDER PARTICLE MOTION EQUATIONS AND LINEAR CHROMATICITY CALCULATION IN ACCELERATOR RINGS**
R. Z. Liu (China Univ. of Science and Technology) Jan. 1984 47 p refs
(Contracts DE-AC03-76SF-00515; DE-AC03-82ER-13000)
(DE84-005895; SU-SLAC/AP-11) Avail: NTIS HC A03/MF A01

A thorough study on the second order particle motion equations, both in continuous field and in hard edges, with emphasis put on the latter is presented. Having quite general conditions and strict mathematical treatments, it provides a sound ground from which many problems can be solved without fear of being misled. Then the linear chromaticity (CHR) calculation is inspected, the first step being a general analytical expression of the transverse oscillation phase increment due to a small disturbance. The expression for the CHR is then readily obtained since tune is the transverse oscillation number per turn and the CHR is the linear dependence of the tune on particle energy/momentum deviation. The last part gives the formulae for practical CHR calculation, which are general enough to include almost all the magnet types commonly used in various accelerator rings and are simpler than can be found elsewhere. DOE

**N84-22392#** Louisiana State Univ., Baton Rouge.
**RESEARCH IN ELEMENTARY PARTICLE PHYSICS Progress Report, 1 May 1983 - 29 Feb. 1984**
L. H. Chan, R. Haymaker, R. Imlay, and W. Metcalf 1984 48 p refs
(Contract DE-AS05-77ER-05490)
(DE84-006130; DOE/ER-05490/41) Avail: NTIS HC A03/MF A01

Theoretical work on an effective low energy theory of hadrons, dynamical symmetry breaking, supersymmetry and the phenomenology of Higgs Particles is described. This experiment is the study of electron-positron annihilations in the region of the upsilon family of particles with an apparatus optimized for detecting leptons and photons. The UPSILON (triple prime) is observed with properties consistent with its being above threshold for B meson production and several decay modes are studied in detail. The (PI) (PI) decays of the UPSILON (prime) and UPSILON (double prime) also measured as well as electronmagnetic transition among the b anti b bond states. DOE

**N84-22393#** California Univ., San Diego, La Jolla. Dept. of Physics.
**EXCITATION OF SIMPLE ATOMS BY SLOW MAGNETIC MONOPOLES**
Norman M. Kroll, Stephen J. Parke (Fermi National Accelerator Lab.), Venkatesh Ganapthi, and Sidney D. Drell (Stanford Linear Accelerator Center) Jan. 1984 17 p refs Presented at the Monopole Conf., Ann Arbor, Mich., 6-9 Oct. 1983
(Contracts DE-AC03-76SF-00515; DE-AT03-S1ER-40029)
(DE84-006209; SU-SLAC-PUB-3281; CONF-8310227-2) Avail: NTIS HC A02/MF A01

A theory of excitation of simple atoms by slow moving massive monopoles is presented. Previously presented results for a monopole of Dirac strength on hydrogen and helium are reviewed. The hydrogen theory is extended to include arbitrary integral multiples of the Dirac pole strength. The excitation of helium by double strength poles and by dyons is also discussed. A helium proportional counter is a reliable and effective detector for monopoles of arbitrary strength, and for negatively charged dyons. DOE

**N84-22394#** California Univ., Berkeley. Lawrence Berkeley Lab.
**FAULT DETECTION AND PROTECTION SYSTEM FOR NEUTRAL BEAM GENERATORS ON THE NEUTRAL BEAM ENGINEERING TEST FACILITY (NBETF)**
G. J. deVries, K. L. Chesley, and H. M. Owren Dec. 1983 6 p refs
(Contract DE-AC03-76SF-00098)
(DE84-006634; LBL-16142) Avail: NTIS HC A02/MF A01

Neutral beam sources, their power supplies and instrumentation can be damaged from high voltage sparkdown or from overheating due to excessive currents. The Neutral Beam Engineering Test Facility (NBETF) in Berkeley has protective electronic hardware that senses a condition outside a safe operating range and generates a response to terminate such a fault condition. The signals monitored, calibration, inhibit type, and persistance time are described as well as the threshold detector, the OR-gate logic, the pulse generator, and the packaging. Block diagrams are included. DOE

**N84-22395#** Bendix Corp., North Hollywood, Calif. Accelerator Dept.
**DESIGN DESIDERATA FOR A LAMINAR FLOW QUADRUPOLE-FOCUSED ACCELERATION COLUMN**
A. W. Maschke 1983 2 p refs Presented at the 3rd Intern. Symp. on the Production and Neutralization of Negative Ions and Beams, Upton, N.Y., 14-18 Nov. 1983
(Contract DE-AC02-76CH-00016)
(DE84-006534; BNL-34186; CONF-831180-19) Avail: NTIS HC A02/MF n A01

The Pierce design acceleration column was widely used to accelerate high current beams. It operates well in the space charge limited condition, and will produce beams with a temperature comparable with that of the source. Current density is restricted, however, by the Child-Langmuir relation. If the ion source itself is not the limiting constraint, then the achievable current density is limited by the electric field at which sparking occurs. The achievable current density decreases as one goes to higher voltages. This can be easily overcome by using electrostatic quadrupole focusing in the acceleration column. The space charge limited current density in a constant energy quadrupole transport channel is greater than that if one assumes that the electric fields on the quadrupoles is as high in the ion source extraction electric fields. In practice, this is a conservative assumption. DOE

# 73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

**N84-22396*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**AN ABRASION-ABLATION MODEL DESCRIPTION OF GALACTIC HEAVY-ION FRAGMENTATION**
Lawrence W. Townsend, John W. Wilson, John W. Norbury (Old Dominion Univ.), and Hari B. Bidasaria (Old Dominion Univ.) Apr. 1984 20 p refs
(NASA-TP-2305; L-15763; NAS 1.60:2305) Avail: NTIS HC A02/MF A01 CSCL 03B

The fragmentation of high-energy galactic heavy ions by nuclear interactions with arbitrary target nuclei is described within the context of a simple abrasion-ablation fragmentation model.

The abrasion part of the theory utilizes a quantum-mechanical formalism based upon an optical model potential approximation to the exact nucleus-nucleus multiple-scattering series. Nuclear charge distributions of the excited prefragments are calculated using either a hypergeometric distribution or a method based upon the zero-point oscillations of the giant dipole resonance. The excitation energy of the prefragment is estimated from the geometric clean-cut abrasion-ablation model. The decay probabilities for the various particle emission channels, in the ablation stage of the fragmentation, are obtained from the EVAP-4 Monte Carlo computer program. Elemental production cross sections for 1.88-GeV/nucleon iron colliding with carbon, silver, and lead targets are calculated and compared with experimental data and with the predictions from the semiempirical relations of Silberberg and Tsao. Author

**N84-22397#** Sandia Labs., Albuquerque, N. Mex.
**RELIABILITY ANALYSIS USING NETWORK SIMULATION**
1984 24 p refs Presented at the Symp. on Space Nucl. Power Systems, Albuquerque, N. Mex., 10 Jan. 1984
(Contract DE-AC04-76DP-00789)
(DE84-006990; CONF-840113-7) Avail: NTIS HC A02/MF A01

A computer code that uses a dynamic, Monte Carlo modeling approach is Q-GERT (Graphical Evaluation and Review Technique–with Queueing), and the present study was demonstrated the feasibility of using Q-GERT for modeling time-dependent, unconditionally and conditionally linked phenomena that are characterized by arbitrarily selected probability distributions. DOE

**N84-22398#** Los Alamos Scientific Lab., N. Mex.
**SPACE NUCLEAR SAFETY PROGRAM Progress Report, Jul. 1983**
S. E. Bronisz, comp. Nov. 1983 7 p
(Contract W-7405-eng-36)
(DE84-003558; LA-9939-PR) Avail: NTIS HC A02/MF A01

Ongoing activities in preparation for tests to determine the response of partial general purpose heat source modules to nominal calculated environment of an orbital decay impact are reported. Topics cover simulation of reentry ablation, safety verification tests, temperature calibration, the five watt system, and compatibility. Solid propellant fire, seawater immersion, capsule surface contamination, helium release, and data acquisition are also considered. A.R.H.

**N84-22399#** Los Alamos Scientific Lab., N. Mex.
**SPACE NUCLEAR SAFETY PROGRAM Progress Report, Aug. 1983**
S. E. Bronisz, comp. Jan. 1984 8 p
(Contract W-7405-eng-36)
(DE84-006693; LA-9980-PR) Avail: NTIS HC A02/MF A01

The scheduled 38-day, 1287 degree C aging of the impact assembly of a general purpose heat source was completed and it was subjected to the standard orbital decay reentry heating simulation. Results are given. Also discussed is the exposure to seawater of a lightweight radioisotope heater unit. DOE

**N84-22400#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**SOME ASPECTS OF THE HIGH EQUATORIAL ORBIT FOR THE TROPICAL EARTH RESOURCES SATELLITE (TERS)**
T. vanderPloeg Nov. 1983 60 p refs Sponsored by Royal Netherlands Aircraft Factory Fokker
(VTH-LR-404) Avail: NTIS HC A04/MF A01

The sensitivity of the high equatorial orbit of the Tropical Earth Resources Satellite (TERS) to particular terms of the geopotential was analyzed. Results were used to define the Earth's gravity model to be applied for the analysis of the long term evolution of the mean orbital elements. A short-arc analysis was performed to study the effects of perturbing forces on the instantaneous orbital position of the satellite. The effects of injection and orbit determination errors on the along track position of the satellite were also investigated. For along track position, injection errors are more important than perturbing forces. Author (ESA)

# 74 OPTICS

Includes light phenomena.

**N84-22401** Prins Maurits Lab. TNO, Rijswijk (Netherlands).
**DESCRIPTION OF OPTICAL MEASUREMENT TECHNIQUES FOR THE INTERACTION OF SHOCK WAVES WITH OBJECTS [BESCHRIJVING VAN ENKELE OPTISCHE MEETTECHNIEKEN MET BETREKKING TOT DE INTERAKTIE VAN SCHOKGOLVEN MET OBJEKTEN]**
C. N. Deventer Jan. 1983 22 p refs In DUTCH; ENGLISH summary
(PML-1983-10; TDCK-77823) Avail: Issuing Activity

Observation of the interaction of shock waves with objects by holographic interferometry, speckle photography, shearography, Moire methods, grid photography, stereophotogrammetry, and photoelastic investigation is described. The optimal method depends on the magnitude and the associated rate of deformation. Author (ESA)

**N84-22402*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**OPTICAL INFORMATION PROCESSING FOR AEROSPACE APPLICATIONS 2**
Robert L. Stermer, comp. Washington Mar. 1984 261 p refs Conf. held in Hampton, Va., 30-31 Aug. 1983
(NASA-CP-2302; L-15754; NAS 1.55:2302) Avail: NTIS HC A12/MF A01 CSCL 20F

Current research in optical processing, and determination of its role in future aerospace systems was reviewed. It is shown that optical processing offers significant potential for aircraft and spacecraft control, pattern recognition, and robotics. It is demonstrated that the development of optical devices and components can be implemented in practical aerospace configurations. For individual titles, see N84-22403 through N84-22420.

**N84-22403*#** Defense Advanced Research Projects Agency, Arlington, Va. Defense Sciences Office.
**FUTURE DIRECTIONS IN OPTICAL PROCESSING**
John A. Neff *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 1-18 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

Three aspects of optical processing are discussed. The three aspects are: (1) the potential of this emerging technology; (2) the major limitations preventing wide scale implementation of optical processors and the importance of future research in these areas is emphasized; (3) the importance of nonlinear optics in developing optoelectronic interconnects for VLSI. E.A.K.

**N84-22404*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**IMAGE-PLANE PROCESSING FOR IMPROVED COMPUTER VISION**
F. O. Huck, C. L. Fales, S. K. Park, and R. W. Samms (Information and Control Systems, Inc., Hampton, Va.) *In its* Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 19-34 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

The proper combination of optical design with image plane processing, as in the mechanism of human vision, which allows to improve the performance of sensor array imaging systems for edge detection and location was examined. Two dimensional bandpass filtering during image formation, optimizes edge enhancement and minimizes data transmission. It permits control of the spatial imaging system response to tradeoff edge enhancement for sensitivity at low light levels. It is shown that most of the information, up to about 94%, is contained in the signal intensity transitions from which the location of edges is determined for raw primal sketches. Shading the lens transmittance to increase depth of field and using a hexagonal instead of square sensor array lattice to decrease sensitivity to edge orientation improves edge information about 10%. E.A.K.

**N84-22405*#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical and Computer Engineering.
**OPTICAL SYSTOLIC SOLUTIONS OF LINEAR ALGEBRAIC EQUATIONS**
Charles P. Neuman and David Casasent *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 35-51 refs (For primary document see N84-22402 12-74)
(Grants NAG3-5; AF-AFOSR-0091-79)
Avail: NTIS HC A12/MF A01 CSCL 20F

The philosophy and data encoding possible in systolic array optical processor (SAOP) were reviewed. The multitude of linear algebraic operations achievable on this architecture is examined. These operations include such linear algebraic algorithms as: matrix-decomposition, direct and indirect solutions, implicit and explicit methods for partial differential equations, eigenvalue and eigenvector calculations, and singular value decomposition. This architecture can be utilized to realize general techniques for solving matrix linear and nonlinear algebraic equations, least mean square error solutions, FIR filters, and nested-loop algorithms for control engineering applications. The data flow and pipelining of operations, design of parallel algorithms and flexible architectures, application of these architectures to computationally intensive physical problems, error source modeling of optical processors, and matching of the computational needs of practical engineering problems to the capabilities of optical processors are emphasized. E.A.K.

**N84-22406*#** Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
**ADVANCES IN WHITE-LIGHT OPTICAL SIGNAL PROCESSING**
F. T. S. Yu *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 53-69 refs Sponsored by AFOSR (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

A technique that permits signal processing operations which can be carried out by white light source is described. The method performs signal processing that obeys the concept of coherent light rather than incoherent optics. Since the white light source contains all the color wavelengths of the visible light, the technique is very suitable for color signal processing. E.A.K.

**N84-22407*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**SPATIAL INTERFEROMETRY FOR WHITE LIGHT PROCESSING: THE COHERENCE INTERFEROMETER**
J. B. Breckinridge *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 71-81 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

An optical systems design approach for a parallel optical processor that has an information throughput capacity in excess of one petabit per second is discussed. This system enables predetection processing of white light, passively illuminated scenes. Integrated with a programmable Van der Lugt filter, this system is an effective data compression method. A program to implement this parallel optical processing by interferometry system is discussed. E.A.K.

**N84-22408*#** Texas Instruments, Inc., Dallas. Central Research Labs.
**A HYBRID SILICON MEMBRANE SPATIAL LIGHT MODULATOR FOR OPTICAL INFORMATION PROCESSING**
Dennis R. Pape and Larry J. Hornbeck *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 83-103 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

A new two dimensional, fast, analog, electrically addressable, silicon based membrane spatial light modulator (SLM) was developed for optical information processing applications. Coherent light reflected from the mirror elements is phase modulated producing an optical Fourier transform of an analog signal input to the device. The DMD architecture and operating parameters related to this application are presented. A model is developed that describes the optical Fourier transform properties of the DMD. E.A.K.

**N84-22409*#** Hughes Research Labs., Malibu, Calif.
**THE APPLICATIONS OF SILICON LIQUID CRYSTAL LIGHT VALVES TO OPTICAL DATA PROCESSING: A REVIEW**
U. Efron, B. H. Soffer, and H. J. Caulfield (Aerodyne Research, Inc., Billerica, Mass.) *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 105-117 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

The applications of the photo-activated, the CCD-addressed, and the variable-grating mode liquid crystal light valves (LCLVs) to optical data processing are described. These applications include image correlation, level slicing, spectral analysis and correlation, bi-spectral image division, and matrix-matrix multiplication. Author

**N84-22410*#** Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.
**MAGNETO-OPTIC GARNET AND LIQUID CRYSTAL OPTICAL SWITCHES**
J. A. Krawczak, E. J. Torok, W. A. Harvey, F. G. Hewitt, and G. L. Nelson *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 119-134 refs Sponsored by Army Research Office (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

Magnetic stripe domain and liquid crystal devices are being developed and evaluated as fiber optic switches that can be utilized for nonblocking type nxm optical matrix switches in networking and optical processing. Liquid crystal switches are characterized by very low insertion loss and crosstalk, while stripe domain switches commutate in less than one microsecond. Both switches operate on multimode, randomly polarized fiber light with potentially large values for (n,m). The applications of these magnetic stripe domain and liquid crystal devices are discussed. R.J.F.

**N84-22411*#** Arizona Univ., Tucson. Optical Sciences Center.
**OPTICAL BISTABILITY: A NOVEL APPROACH TO OPTICAL SIGNAL PROCESSING AND COMMUNICATIONS**
N. Peyghambarian *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 135-148 refs Sponsored by NSF, AFOSR, and Army Research Office (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

Optical bistability and its potential for optical signal processing and communications are reviewed. Recent experimental results in semiconductor optical bistability are presented. In particular, optical bistability in GaAs-AlGaAs superlattices and CuCl, ZnS, and ZnSe is discussed. Author

**N84-22412*#** California Univ., Irvine. Dept. of Electrical Engineering.
**HYBRID INTEGRATED OPTIC MODULES FOR REAL-TIME SIGNAL PROCESSING**
Chen S. Tsai *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 149-164 refs Sponsored by AFOSR and Army Research Office (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

The most recent progress on four relatively new hybrid integrated optic device modules in LiNbO3 waveguides and one in YIG/GGG waveguide that are currently being studied are discussed. The five hybrid modules include a time-integrating acoustooptic correlator, a channel waveguide acoustooptic frequency shifter/modulator, an electrooptic channel waveguide total internal reflection moculator/switch, an electrooptic analog-to-digital converter using a Fabry-Perot modulator array, and a noncollinear magnetooptic modulator using magnetostatic surface waves. All of these devices possess the desirable characteristics of very large bandwidth (GHz or higher), very small substrate size along the optical path (typically 1.5 cm or less), single-mode optical

propagation, and low drive power requirement. The devices utilize either acoustooptic, electrooptic or magnetooptic effects in planar or channel waveguides and, therefore, act as efficient interface devices between a light wave and temporal signals. Major areas of application lie in wideband multichannel optical real-time signal processing and communications. Some of the specific applications include spectral analysis and correlation of radio frequency (RF) signals, fiber-optic sensing, optical computing and multiport switching/routing, and analog-to-digital conversion of wide RF signals. R.J.F.

**N84-22413*#** Harry Diamond Labs., Adelphi, Md.
**A NEW MULTIFUNCTION ACOUSTO-OPTIC SIGNAL PROCESSOR**
N. J. Berg, M. W. Casseday, A. N. Filipov, and J. M. Pellegrino *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 165-178 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

An acousto-optic architecture for simultaneously obtaining time integration correlation and high-speed power spectrum analysis was constructed using commercially available TeO2 modulators and photodiode detector-arrays. The correlator section of the processor uses coherent interferometry to attain maximum bandwidth and dynamic range while achieving a time-bandwidth product of 1 million. Two correllator outputs are achieved in this system configuration. One is optically filtered and magnified 2 : 1 to decrease the spatial frequency to a level where a 25-MHz bandwidth may be sampled by a 62-mm array with elements on 25-micro centers. The other output is magnified by a factor of 10 such that the center 4 microseconds of information is available for estimation of time-difference-of-arrival to within 10 ns. The Bragg cell spectrum-analyzer section, which also has two outputs, resolves a 25-MHz instantaneous bandwidth to 25 kHz and can determine discrete-frequency reception time to within 15 microseconds. A microprocessor combines spectrum analysis information with that obtained from the correlator. R.J.F.

**N84-22414*#** Ohio State Univ., Columbus. Electroscience Lab.
**OPTICAL PULSE GENERATOR USING LIQUID CRYSTAL LIGHT VALVE**
Stuart A. Collins, Jr. *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 179-189 refs (For primary document see N84-22402 12-74)
(Grant NsG-3302)
Avail: NTIS HC A12/MF A01 CSCL 20F

Numerical optical computing is discussed. A design for an optical pulse generator using a Hughes Liquid crystal light valve and intended for application as an optical clock in a numerical optical computer is considered. The pulse generator is similar in concept to the familiar electronic multivibrator, having a flip-flop and delay units. R.J.F.

**N84-22415*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**PROGRAMMABLE MASKS FOR OPTICAL INFORMATION PROCESSING**
J. H. Goebel, T. Matsumoto, C. Mina, and J. Welch *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 191-197 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

Research in progress at NASA Ames Research Center on programmable masks is discussed in this paper. One type is a large area format liquid crystal mask intended for binary optical computation problems. To date, an on-off contrast ratio of > 500:1 has been achieved at a switching rate of < 1 Hz. With a 32 x 32 format, a ratio 10 to the 4th power:1 is desirable. The switching contrast is entirely dependent on the polarized quality; therefore, it is believed that 10 to the 4th power:1 in transmission is possible. Larger format masks are under development. An application to Hadamard transform polarized imagery at wavelengths of 1.0 to 2.0 micrometers, which is competitive with the best monolithic infrared detector arrays, is discussed. B.W.

**N84-22416*#** California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
**REAL-TIME SYNTHETIC APERTURE RADAR PROCESSING** c32
Demetri Psaltis, Michael Haney, and Kelvin Wagner *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 199-213 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 17I

Real-time acousto-optic SAR processors are described and experimentally demonstrated. SAR imaging is performed in one of the architectures by applying the signal to an acousto-optic device and correlating it with chirp signals recorded on an optical transparency by time integration on a CCD detector. In a different implementation, the imaging is preformed by interfering the light beams diffracted from two separate acousto-optic devices, one modulated the radar signal and the second by the reference chirp waveform. Author

**N84-22417*#** Ohio State Univ., Columbus. Electroscience Lab.
**OPTICAL RESIDUE ADDITION AND STORAGE UNITS USING A HUGHES LIQUID CRYSTAL LIGHT VALVE**
Sarry F. Habiby and Stuart A. Collins, Jr. *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 215-229 refs (For primary document see N84-22402 12-74)
(Grant NsG-3302)
Avail: NTIS HC A12/MF A01 CSCL 20F

Optical addition and storage units are described in this paper. These units are implemented using the Hughes Liquid Crystal Light Valve (LCLV) as a spatial light modulator using residue arithmetic for a numerical representation. The main hardware components of the design, besides the light valve, include an array of single-mode optical fibers that provide input information, a polarizing prism in combination with quarter-wave and half-wave retarders for residue arithmetic implementation in the adder, and a holographic array for spatial stability in the storage unit. Author

**N84-22418*#** Battelle Columbus Labs., Ohio. Sponsored by AFOSR
**INTEGRATED-OPTICAL APPROACHES TO MATRIX MULTIPLICATION**
C. M. Verber and R. P. Kenan *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 231-241 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

The solution of matrix equations is essential to carrying out a large variety of control algorithms and to reducing certain types of data such as the output of a multispectral sensor array. Optical techniques and, in particular, integrated-optical circuits (IOC's) can provide compact, low-power devices for performing the mitrix multiplications necessary for the solution of these problems. A specific IOC for performing vector-matrix multiplication and several approaches to the design of IOC's for matrix-matrix multiplication will be discussed. Author

**N84-22419*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SYSTOLIC TRIPLE-MATRIX PRODUCT CALCULATIONS**
H. J. Caulfield (Innovative Optics, Inc., Concord, Mass.), C. M. Verber (Battelle Columbus Labs., Ohio), and Robert L. Stermer *In its* Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 243-247 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

In order to handle arbitrary-sized matrices with fixed-sized optical matrix processors, it is necessary to expand or contract the problem to fit the processor. This preprocessing is examined. It is applied to the type of triple-matrix product calculation needed for Kalman filtering. Emphasis will be placed on systolic-type processors. B.W.

**N84-22420*#** Naval Research Lab., Washington, D. C.
**INTEGRATED OPTICAL SIGNAL PROCESSING WITH MAGNETOSTATIC WAVES**
A. D. Fisher and John N. Lee *In* NASA. Langley Research Center Opt. Inform. Process. for Aerospace Appl. 2 Mar. 1984 p 249-261 refs (For primary document see N84-22402 12-74)
Avail: NTIS HC A12/MF A01 CSCL 20F

Magneto-optical devices based on Bragg diffraction of light by magnetostatic waves (MSW's) offer the potential of large time-bandwidth optical signal processing at microwave frequencies of 1 to 20 GHz and higher. A thin-film integrated-optical configuration, with the interacting MSW and guided-optical wave both propagating in a common ferrite layer, is necessary to avoid shape-factor demagnetization effects. The underlying theory of the MSW-optical interaction is outlined, including the development of expressions for optical diffraction efficiency as a function of MSW power and other relevant parameters. Bradd diffraction of guided-optical waves by transversely-propagating magnetostatic waves and collinear TE/TM mode conversion included by MSW's have been demonstrated in yttrium iron garnet (YIG) thin films. Diffraction levels as large as 4% (7 mm interaction length) and a modulation dynamic range of approx 30 dB have been observed. Advantages of these MSW-based devices over the analogous acousto-optical devices include: much greater operating frequencies, tunability of the MSW dispersion relation by varying either the RF frequency or the applied bias magnetic field, simple broad-band MSW transducer structures (e.g., a single stripline), and the potential for very high diffraction efficiencies. B.W.

**N84-22421*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**METHOD OF REDUCING TEMPERATURE IN HIGH-SPEED PHOTOGRAPHY**
Ernie D. Walker and Howard A. Slater (Rochester Inst. of Tech.) Mar. 1984 9 p refs
(NASA-TM-83620; E-2021; NAS 1.15:83620) Avail: NTIS HC A02/MF A01 CSCL 20F

A continuing problem in high-speed motion picture photography is adequate lighting and the associated temperature rise. Large temperature rises can damage subject matter and make recording of the desired images impossible. The problem is more severe in macrophotography because of bellows extension and the necessary increase in light. This report covers one approach to reducing the initial temperature rise: the use of filters and heat-absorbing materials. The accompanying figures provide the starting point for selecting distance as a function of light intensity and determining the associated temperature rise. Using these figures will allow the photographer greater freedom in meeting different photographic situations. Author

**N84-22422*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**BACKGROUND SOURCES IN OPTICAL COMMUNICATIONS**
Victor A. Vilnrotter 15 Nov. 1983 32 p refs
(NASA-CR-173457; JPL-Pub-83-72; NAS 1.26:173457) Avail: NTIS HC A03/MF A01 CSCL 20F

The characterization and measurement of background radiation relevant to optical communications system performance is addressed. The necessary optical receiver parameters are described, and radiometric concepts required for the calculation of collected background power are developed. The most important components of optical background power are discussed, and their contribution to the total collected background power in various communications scenarios is examined. Author

**N84-22423*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**THERMAL CONTACTS BETWEEN METAL AND GLASS FOR USE AT CRYOGENIC TEMPERATURES**
Kevin OBrien and Fred C. Witteborn Mar. 1984 13 p refs
(NASA-TM-85856; A-9518; NAS 1.15:85856) Avail: NTIS HC A02/MF A01 CSCL 20F

Thermal contacts designed to cool a 50-cm diam fused-silica mirror to 5 K without serious distortion of the optical surfaces were tested. Rubber cement and copper-filled rubber cement were found to be well suited for maintaining thermal contact between the fused-silica and copper straps. A variety of other adhesives proved to be unreliable because they spalled the glass. The thermal resistances of the rubber cement and copper-filled rubber cement were determined. For the copper-filled rubber cement, the thermal resistances varied from 570 K/W at 60 K to 15,000 K/W at 10 K. Author

**N84-22424#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**PASSIVE INFRARED RANGING M.S. Thesis**
N. K. Leonpacher Dec. 1983 210 p
(AD-A138066; AFIT/GEP/PH/83D-5) Avail: NTIS HC A10/MF A01 CSCL 17/5

The range of an infrared source was estimated by analyzing the atmospheric absorption by CO2 in several wavelength intervals of its spectrum. These bandpasses were located at the edge of the CO2 absorption band near 2300 1/cm (4.3 micron). A specific algorithm to predict range was determined based on numerous computer generated spectra. When tested with these spectra, range estimates within 0.8 km were obtained for ranges between 0 and 18 km. Accuracy decreased when actual source spectra were tested. Although actual spectra were available only for ranges to 5 km, 63% of these spectra resulted in range estimates that were within 1.6 km of the actual range. Specific spectral conditions that affected the range predictions were found. Methods to correct the deficiencies were discussed. Errors from atmospheric variations, and the effects of background noise, were also investigated. Limits on accuracy and range resolution were determined. Author (GRA)

**N84-22425#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**DECONVOLUTION OF ABERRATIONS IN OPTICAL SYSTEMS Ph.D. Thesis**
C. S. Davis 9 Dec. 1983 153 p
(DA Proj. C22-3)
(AD-A138096; AFIT/DS/EE/83-1) Avail: NTIS HC A08/MF A01 CSCL 12/1

Methods are developed for estimating aberrations on the elements of a two-element optical system based on knowledge of the input and output fields. The equation is written for the propagation of a scalar, quasi-monochromatic field through the system, and the output field is assumed measurable at a given plane. The resulting convolution integral contains the unknown aberration functions in the integrand. The integral equation is a Fredholm equation of the first kind, and the integrand is a nonlinear function of the aberrations. The integral is completed by the method of stationary phase. Methods for estimating the aberration functions are developed, and the effects of noisy measurements are considered. A computerized algorithm that will estimate the Fourier coefficients of the aberration functions is demonstrated for a simple deconvolution problem. Author (GRA)

**N84-22426#** Indiana Univ., Bloomington. Bloomington Dept. of Chemistry.
**A COMPARISON OF SIGNAL-TO-NOISE RATIOS FOR NEAR-INFRARED DETECTORS Interim Technical Report**
J. E. Freeman and G. M. Hieftje 30 Jan. 1984 33 p
(Contract N00014-76-C-0838)
(AD-A138127; AD-E440224; INDU/DC/GMH/TR-84-59; TR-68)
Avail: NTIS HC A03/MF A01 CSCL 17/5

Five detectors sensitive in the near-infrared, including two photomultiplier tubes, a silicon photodiode, a silicon photodiode array, and a lead-sulfide photoconductor, are evaluated in terms of signal-to-noise ratios. Theoretical noise and signal calculations are compared to measured noise values and relative responses. The spectral response of the detectors between 700 and 1200 nm is also reported. The relative merits of a particular detector are a function of wavelength, photon flux and other criteria.
Author (GRA)

**N84-22427#** IBM Research Lab., San Jose, Calif.
**TECHNIQUES OF FLASH RADIOMETRY**
W. P. Leung and A. C. Tam 20 Jan. 1984 33 p
(Contract N00014-83-C-0170)
(AD-A138412; RJ-4152(45940); TR-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

This document analyzes in detail flash radiometry techniques for determining the thermal diffusivity of thin condensed samples. Such techniques rely on the transient infrared radiation from the sample heated by a short-duration pulsed radiation. Exact analytical solution for the conventional transmission measurement (in which the excitation source and the infrared detector are on opposite sides of the sample) as well as the backscattering measurement (in which the excitation source and detector are on the same side of the sample) are presented with the effect of heat loss neglected. The analysis allows the determination of the thermal diffusivity and the absorption coefficients at the excitation wavelength and at the detecting wavelength of the sample from the experimental data. The effects of excitation pulse duration and finite rise time of the detection system are discussed. Experiments on pulsed radiometry measurements on thin film samples are performed to verify some of these theoretical predictions. Radiation loss and two-dimensional head diffusion loss are shown to be negligible for thin film samples. Author (GRA)

**N84-22428#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**IMAGE FILTERING WITH BOOLEAN AND STATISTICAL OPERATORS M.S. Thesis**
R. D. Wells Dec. 1983 230 p
(AD-A138421; AFIT/GE/EE/83D-72) Avail: NTIS HC A11/MF A01 CSCL 20/6

Edge extraction is an image processing technique for defining the edge information in an image. This effort researches different edging processes as applied to preprocessing for two pattern recognition processes. The first one is a cross-correlation method to find a target given that the target has a known size, orientation, and aspect. Correlation is performed in the spatial frequency domain with two-dimensional fast Fourier transforms of the searched edge image and a hand drawn edge template to correct for translation only. The second pattern recognition process researched also uses edging as one step of a purely spatial domain algorithm. The approach locates targets in infrared images that can be described as hot clusters. A cluster recognition algorithm by Hamadani is implemented and altered for testing of local thresholding and thresholding rules. The algorithm is shown to be effective on real infrared images. Author (GRA)

**N84-22429#** Naval Postgraduate School, Monterey, Calif.
**MEASUREMENTS OF DIRECT PATH AND FOLDED PATH OPTICAL SCINTILLATION USING A CORNER CUBE REFLECTOR M.S. Thesis**
L. M. Henry Dec. 1983 74 p
(AD-A138485) Avail: NTIS HC A04/MF A01 CSCL 20/6

A theoretical prediction of path weighting for optical scintillation strength was made by Dr. Avihu Ze'evi. As part of a continuing effort at NPS to verify the prediction, a sixty-one meter enclosed tunnel was constructed, allowing the position of a turbulence source to be varied. This experiment tested the Ze'evi hypothesis using a corner cube reflector. The results confirm patterns found in previous experiments, and the general form of the predicted path weighting. However, questions concerning the nature of the turbulence present in the tunnel do not allow strong conclusions to be formed. Author (GRA)

**N84-22430#** Naval Research Lab., Washington, D. C. Transmission Technology Branch.
**ANALOG FIBER OPTICS: PRAGMATIC CONSIDERATIONS BEYOND THE TEXTBOOK Interim Report**
E. L. Althouse, D. M. Kopp, and R. G. Trgina 29 Dec. 1983 62 p
(F21-222)
(AD-A137528; AD-E000558; NRL-MR-5215) Avail: NTIS HC A04/MF A01 CSCL 20/6

This report discusses the use of AlGaAs lasers and LEDs as optical sources for a multimode fiber optic link that uses analog modulation. It is well known that the limited linearity of these sources makes digital modulation a preferable method to send information. However, many factors determine how a portion of an information transfer system is constructed or retrofitted including previous investments in associated electrical and electro optical hardware, the cost of redesigning the system architecture, and, in some instances, the difficulty in digitizing certain modulation waveforms. This report is written primarily for the fiber optic design engineer that uses analog modulation, for whatever justification, but many aspects will also be of use for those who design with the traditional digital approach. GRA

**N84-22431#** Los Alamos Scientific Lab., N. Mex.
**OPTICAL ENGINEERING AT LOS ALAMOS: A HISTORY**
Berlyn Brixner 1983 16 p refs Presented at the Soc. of Photo-Opt. Instrumentation Engr. Conf., Santa Fe, N. Mex., 11-15 Apr. 1983
(Contract W-7405-eng-36)
(DE83-009905; LA-UR-83-953; CONF-830425-3) Avail: NTIS HC A02/MF A01

Optical engineering at Los Alamos, has continued because scientific researchers usually want more resolving power than commercially available optical instruments provide. In addition, in-house engineering is often advantageous - when the technology for designing and making improved instrumentation is available locally - because of our remote location and the frequent need for accurate data. As a consequence, a number of improved research cameras and lens systems were developed locally - especially for explosion and implosion photography, but even for oscilloscope photography.The development of high-speed cameras led to the ultimate in practical high-speed rotating mirrors and to the invention of a rapid, precise, and effective lens design procedure that has produced more than a hundred lens system that gives improved imaging in special conditions of use. Representative examples of this work are described. DOE

**N84-22432#** Rochester Univ., N. Y. Inst. of Optics.
**NONLINEAR OPTICS WITH BROAD-BAND LASERS Progress Report, 15 Jul. 1983 - 14 Jul. 1984**
Michael G. Raymer Jan. 1984 10 p refs
(Contract DE-AC02-81ER-10979)
(DE84-005769; DOE/ER-10979/5) Avail: NTIS HC A02/MF A01

Results are obtained in the areas of statistical properties of dye laser radiation and stimulated Raman scattering (SRS) with broad-band chaotic light. Experiments were carried out on a multimode, pulsed dye laser to measure the mode intensity cross-correlation coefficients. This revealed that the mode intensities are statistically correlated, some pairs in a positive fashion and some in a negative fashion. The results can be explained by the effect of spatial hole burning in the dye gain medium. A theory was developed to describe SRS driven by a chaotic laser. It was found that the Raman gain is a strong function of laser bandwidth. DOE

**N84-22433#** California Univ., Livermore. Lawrence Livermore Lab.
**LARGE APERTURE OPTICAL SWITCHING DEVICES**
J. Goldhar and M. A. Henesian 12 Dec. 1983 29 p refs Presented at the SPIE Tech. Symp. and Instrument Exhibit, Los Angeles, 22-27 Jan. 1984
(Contract W-7405-eng-48)
(DE84-005126; UCRL-90107; CONF-840139-1) Avail: NTIS HC A03/MF A01

An approach to constructing large aperture optical switches for next generation inertial confinement fusion lasers is presented. A transparent plasma electrode formed in low pressure ionized gas acts as a conductive coating to allow the uniform charging of the optical faces of an electro-optic material. In this manner large electric fields can be applied longitudinally to large aperture, high aspect ratio Pockels cells. A four-electrode geometry is proposed

to create the necessary high conductivity plasma sheets. A fast (less than 10 nsec) switching design in a five cm by five cm aperture potassium dihydrogen phosphate (KDP) Pockels cell is included. Detailed modelling of Pockels cell performance with plasma electrodes is carried out for 15 and 30 cm aperture designs. DOE

**N84-22434#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Kreiselgeraete und Traegheitsnavigation.
**REFLECTIVITY MEASUREMENTS OF LASER GYRO MIRRORS**
Ruediger Rodloff and Werner Jungbluth Oct. 1983 44 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-851)
(DFVLR-FB-83-35; ESA-TT-851) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 16

Reflectivity measurement of laser gyro mirrors using an active optical resonator is described. The measuring method was analyzed and compared to conventional laser mirror measuring results. It is concluded that the simple experimental equipment offers high resolution of 0.0006% and good long term repeatability of 0.013%. Author (ESA)

**N84-22435#** Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe (West Germany).
**ON-LINE PREPROCESSING OF GRAY SCALE IMAGES Final Report, Dec. 1982**
Hermann Ringshauser Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-DV-83-004; ISSN-0170-9011) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11,50

On-line preprocessing of TV images is studied. A system for modular realization of local operators was designed. Size and shape of the operators window can be programmed through the definition of cascadable processing modules. Several operators can be connected in series, in parallel, or in any suitable combination. The system is designed as a stand alone unit with European television standard input/output signals. Programming and communication with the operator is implemented on a hardware-independent level through a CRT terminal. Applications include contrast enhancement, contour extraction, and elimination of varying illumination in industrial image processing as well as correction of blurred images produced by a moving camera. Author (ESA)

**N84-22436#** Battelle Inst., Frankfurt am Main (West Germany).
**RESEARCH AND DEVELOPMENT ON HIGH SENSITIVITY INFRARED DETECTORS, PHASE 3, VQM Final Report, Aug. 1982**
Ulrich Brunsmann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 99 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-83-032; ISSN-0170-1339) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21

High sensitivity extrinsic photoconductive detectors are described. Phosphorus-doped and gallium-doped silicon were used (response peaks of 26 and 15 microns, respectively). The development was aimed at a noise equivalent power of 1/10 to the 16th power W/sq root Hz by photon background flux densities of 10 to the 8th power phot/sqcm sec and chopping frequencies of 10 Hz. The optimum values achieved are 4 by 1/10 to the 17th power W/sq root Hz (Si:P) and 7 by 1/10 to the 17th power W/sq root Hz (Si:Ga). Typical values are 6 by 1/10 to the 17th power W/sq root Hz and 1 by 1/10 to the 16th power W/sq root Hz in the response peak; detectors are provided for the German infrared laboratory Spacelab payload. Author (ESA)

**N84-22358#** Joint Publications Research Service, Arlington, Va.
**FIBER-OPTICS SYMPOSIUM, SCIENTIFIC AGREEMENT DESCRIBE**
Ryszard Romaniuk *In its* East Europe Rept.: Sci. Affairs (JPRS-ESA-84-010) 9 Apr. 1984 p 9-14 refs Transl. into ENGLISH from Nauka Polska (Warsaw), no. 3-4, Mar. - Apr. 1983 p 215-217 (For primary document see N84-22356 12-70)
Avail: NTIS HC A03/MF A01

# 75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**N84-22437#** United Kingdom Atomic Energy Authority, Culham (England).
**POSSIBILITY OF USING PULSED CO2 LASERS FOR RADIATION SCATTERING DIAGNOSTICS IN TOKAMAK PLASMAS**
V. G. Zhukovskii 2 Feb. 1984 73 p refs Transl. into ENGLISH of rept. IAE-3351/7 Inst. of Atomic Energy, Moscow, 1980
(BLL-CTO-2199-(9091.9F); IAE-3351/7) Avail: British Library Lending Div., Boston Spa, Engl.

The possibility is discussed of using pulsed CO2 lasers for measuring basic plasma parameters by the scattering method. In addition to measuring the electron temperature and density one can determine the ion temperature and the effective plasma charge (Z (sub eff)) by small-angle scattering. The use of pulse-periodic CO2 lasers makes it possible to achieve a multipulse operating regime and thereby to investigate the time dependences of the measured plasma parameters. Author

**N84-22438#** Nagoya Univ. (Japan). Inst. of Plasma Physics.
**HEAVY ION FUSION REACTOR HIBLIC-1. CONCEPTUAL DESIGN OF HEAVY ION FUSION REACTOR**
Jan. 1984 198 p refs
(IPPJ-663) Avail: NTIS HC A09/MF A01

An inertial confinement fusion reactor plant named HIBLIC-I (Heavy Ion Beam and Lithium Curtain) is proposed as a conceptual design, which has been worked out in the course of feasibility studies on the heavy ion fusion approach. An accelerator complex (RF linacs, storage rings and linear beam compressors) is adopted as the driver system to provide 6 beams of Pb(=1)-208 ions at 15 GeV. Total beam energy of 4MJ with 160TW power is focused on a single shell, three-layered target of 4mm-phi sphere. This target will give an energy gain of 100. A cylindrical double walled reactor chamber is made of HT-9 ferritic steel with three layers of liquid Li flow inside. The innermost layer forms a Li curtain, which is effective to recover the cavity pressure down to 10(-4) Torr within a repetition time of 1s. A thick upward flow of liquid Li plays the role of coolant and tritium breeder. A driver system is operated at the repetition rate of 10Hz and supplies beams for 10 reactor chambers, each of which is operated at 1Hz repetition. So, the plant yield of fusion power is 4000 MW(th)' corresponding electric power output of 1.5GW. M.G.

**N84-22439#** Science Applications, Inc., McLean, Va.
**VELOCITY SHEAR STABILIZATION OF THE CURRENT CONVECTIVE INSTABILITY Interim Report**
P. Satyanarayana and S. L. Ossakow 6 Feb. 1984 30 p
(S99-QMXB)
(AD-A137963; NRL-MR-5262) Avail: NTIS HC A03/MF A01 CSCL 20/9

A nonlocal theory of the current convective instability in the presence of a transverse velocity shear is developed. It is found that the velocity shear stabilizes the short wavelength modes and preferentially excites a long wavelength mode. Application to east-west structure in the high latitude auroral F layer plasma enhancements is discussed. Author (GRA)

**N84-22440#** Indiana Univ., Bloomington. Dept. of Chemistry.
**MINI, MICRO, AND HIGH-EFFICIENCY TORCHES FOR THE ICP**

**(INDUCTIVELY-COUPLED PLASMA): TOYS OR TOOLS? Interim Technical Report**
Gary M. Hieftje 10 Feb. 1984 23 p Submitted for publication
(Contract N00014-76-C-0838; NR Proj. 051-622)
(AD-A138144; INDU/DC/GMH/TR-84-60; TR-69) Avail: NTIS HC A02/MF A01 CSCL 13/9

Because the inductively-coupled plasma (ICP) is expensive both to purchase and to continue in operation, many workers have sought to reduce both the radiofrequency power and coolant argon ordinarily required to sustain the discharge. In one approach, the ICP has been reduced in size, in the hope that its analytical strengths could be retained but the power and argon required for it reduced. In the second approach, the torch used to support the discharge has been modified extensively. The final and most recent approach utilizes alternative torch cooling schemes using, for example, water of high air flows as a coolant. In this paper, these alternative approaches will be reviewed and assessed in terms of their practicability and analytical capability. Prospects for future torch modifications and low-flow, low-power ICP instrumentation will be considered and discussed. Author (GRA)

**N84-22441#** Berkeley Research Associates, Inc., Calif.
**THE MICROSTRUCTURE THEORY FOR THREE DIMENSIONAL PLASMA TRANSPORT**
C. W. Prettie, S. Y. F. Chu, and J. B. Workman 1 May 1983 130 p
(Contract DNA001-81-C-0061; S99-QAXH)
(AD-A138285; AD-E301333; PD-BRA-83-295R; DNA-TR-81-270) Avail: NTIS HC A07/MF A01 CSCL 20/9

Microstructure theory is a stochastic approach to plasma simulation which accounts for structures unresolved by sampling. A stochastic approach to plasma simulation is called for by the need to address a large range of plasma structure scale sizes in the simulation of high-altitude nuclear environments. The microstructure approach to a 2-dimensional split-step numerical simulation of electrostatic plasma evolution is presented with comparison to the classical split-step approach. The primary difference between the two approaches rests in the assumed dependence of the plasma conductivity upon plasma density statistics. Justification for the microstructure conductivity assumption from numerical experiments is presented. Numerical simulations of barium-like plasma clouds and nuclear clouds under the influence of radial winds are presented which illustrate physically realistic results. Numerical considerations are also discussed. In extensions of microstructure theory from 2-dimensional plasma evolution to 3-dimensional transverse transport the nature of the correlation of plasma structure along magnetic field lines is a key consideration. For the case of complete correlation, i.e., correlation with a correlation coefficient of plus or minus 1, three-dimensional algorithms are developed and implemented in a version of SCENARIO. The algorithms are physically appealing in form, reflecting many of the expected attributes of gradient-drift phenomena. The results of a Cheyenne Mt. calculation are given. GRA

**N84-22442#** Department of Energy, Washington, D. C. Office of Fusion Energy.
**PROCEEDINGS OF THE DOE PLANNING WORKSHOP ON RF THEORY AND COMPUTATIONS**
Jan. 1984 24 p Proc. held in Cambridge, Mass., 12-13 May 1983
(DE84-006670; CONF-8305165-Summ) Avail: NTIS HC A02/MF A01

The status of RF heating in magnetic fusion plasmas was reviewed and the outstanding problems in this area were determined. The term RF heating was understood to encompass not only bulk plasma heating by externally applied electromagnetic power but also current generation in toroidal plasmas and generation of thermal barriers in tandem mirror plasmas. DOE

**N84-22443#** Texas Univ., Austin. Inst. for Fusion Studies.
**RENORMALIZATION THEORY OF STATIONARY HOMOGENEOUS STRONG TURBULENCE IN A COLLISIONLESS PLASMA**
Yang-Zhong Zhang Jan. 1984 59 p refs
(Contract DE-FG05-80ET-53088)
(DE84-006724; DOE/ET-53088/124) Avail: NTIS HC A04/MF A01

A renormalization procedure for the perturbation expansion of the Vlasov-Poisson equation is presented to describe stationary homogeneous turbulence. By using the diagramatic scheme the theory is shown to be renormalizable to any order. The expressions for the renormalized propagator, the renormalized dielectric function, and the intrinsically incoherent source are given. The renormalization leads to a complete separation of the fluctuating distribution function f/sub k/ into two parts, the coherent part, which is proved to represent the dielectric effect of the medium, and the intrinsically incoherent part, which represents the effect of nonlinear source. The turbulent collisional operator in the transport equation is proved equal to GAMMAO, the frequency broadening when k = 0. DOE

**N84-22444#** Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
**GAS FILLED DYNAMICS FOR LASER DRIVEN FUSION REACTORS Final Report, 4 Aug. 1981 - 31 Dec. 1983**
G. A. Moses, T. J. McCarville, and R. R. Peterson Oct. 1983 134 p refs
(Contract DE-AS08-81DP-40157)
(DE84-005181; DOE/DP-40157/1; UWFDM-458) Avail: NTIS HC A07/MF A01

The MF-FIRE computer code is documentated. This code is the same as the FIRE code described in University of Wisconsin Fusion Engineering Program Report UWFDM-407 except that a multifrequency flux limited diffusion radiative transfer option was added. Hence this report is a reproduction of UWFDM-407 with the additional description of the multifrequency radiative transfer. DOE

**N84-22445#** Wisconsin Univ., Madison. Dept. of Plasm Physics Research.
**NEOCLASSICAL CURRENT STUDIES IN HIGH BETA PLASMAS Technical Progress Report, 1 Oct. 1982 - 31 Sep. 1983**
1983 74 p refs
(Contract DE-AC02-83ER-53154)
(DE84-005052; DOE/ER-53154/61) Avail: NTIS HC A04/MF A01

During the 12-month period, October 1, 1982 to September 30, 1983 the Levitated Octupole was dedicated to a study of neoclassical currents. At beta values of a few percent, both the Pfirsch-Schlueter current and the bootstrap current were observed and compared with theoretical predictions. The spatial variation of the current both radially and poloidally are found to agree with the prediction over a wide range of collisionality. A four megawatt ICRH capability exists for sustaining the current in steady state. DOE

**N84-22446#** Naval Research Lab., Washington, D. C. Center for Space Research.
**ATOMIC DATA CALCULATIONS FOR APPLICATION TO THE DIAGNOSTICS OF TOKAMAK PLASMAS. FY 1982 REPORT Final Report**
U. Feldman 3 Oct. 1983 2 p refs
(Contract DE-AI01-82ER-53125)
(DE84-006132; DOE/ER-53125/T1) Avail: NTIS HC A02/MF A01

The intensity of spectral lines that are needed for diagnostic measurement of Tokamak discharges was determined. The calculation of the collision strengths, excitation rate coefficients, level populations and spontaneous decay rates for the configurations 25(2)2p(k),2s2p(k+1), and 2p(k+2) and for the ions with atomic numbers 20<or=z<=36 was completed. DOE

**N84-22447#** Illinois Univ., Urbana. Lab. for Fusion Studies.
**NEGATIVE ION BEAM REQUIREMENTS FOR COMPACT TORI**
George H. Miley 1983 11 p refs Presented at the 3rd Intern. Symp. on the Production and Neutralization of Negative Ions and

Beams, Upton, N.Y., 14-18 Nov. 1983
(Contract DE-AC02-76ET-52040)
(DE84-005752; CONF-831180-18) Avail: NTIS HC A02/MF A01

One potential application of negative ion beams sources involves injection into field-reversed fusion devices for both start-up and sustainment of plasma currents. High energies provide the prerequisite large orbit ions to drive these currents. A hybrid fluid-particle computational model is described that was developed to study injection into a field-reversed mirror. Comparisons with the earlier experiments (2X-IIB) at the Lawrence Livermore National Laboratory are encouraging and support the concept of using high-energy injection in future devices. DOE

**N84-22448#** Texas Univ., Austin. Inst. for Fusion Studies.
**THEORY OF ANOMALOUS TEARING MODE GROWTH AND THE MAJOR TOKAMAK DISRUPTION**
P. H. Diamond, R. D. Hazeltine, Z. G. An, B. A. Carreras (ORNL), and H. R. Hicks (Union Carbide Corp.) Jan. 1984 67 p refs
(Contract W-7405-eng-26; Grant DE-FG05-80ET-53088)
(DE84-005383; DOE/ET-53088/116; IFSR-116) Avail: NTIS HC A04/MF A01

An analytic theory of turbulence in reduced resistive magnetohydrodynamics is developed and applied to the major disruption in Tokamaks. The renormalized equations for a long wavelength tearing instability are derived. The theory predicts two principal nonlinear effects: an anomalous flux diffusivity due to turbulent fluid convection in Ohm's law and a vorticity damping term due to turbulent magnetic stresses in the equation of motion. In the final phase of the disruption, when fine-scale fluid turbulence was generated, detailed considerations show that anomalous diffusivity has the dominant effect at long wavelengths. DOE

**N84-22449#** California Univ., Livermore. Lawrence Livermore Lab.
**RICHTMYER-MESHKOV INSTABILITIES IN STRATIFIED FLUIDS**
Karnig O. Mikaelian 16 Dec. 1983 35 p refs Presented at the Meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Los Angeles, 7-11 Nov. 1983
(Contract W-7405-eng-48)
(DE84-005738; UCRL-90176; CONF-831105-7) Avail: NTIS HC A03/MF A01

An analytic theory of Richtmyer-Meshkov instabilities in an arbitrary number N of stratified fluids subjected to a shock is presented. The theory assumes incompressible flow in which a shock is treated an impulsive acceleration, q = (DELTA) v delta(tau/sub s), (DELTA) s/. The special cases N = 2 and N = 3 are discussed and both Rayleigh-Taylor and Richtmyer-Meshkov instabilities are illustrated by examples patterned after inertial confinement fusion implosions. DOE

**N84-22450#** Oak Ridge National Lab., Tenn. Fusion Engineering Design Center.
**INDUCTIVE CURRENT STARTUP IN LARGE TOKAMAKS WITH EXPANDING MINOR RADIUS AND RF ASSIST Ph.D. Thesis - Michigan Univ.**
S. K. Borowski Feb. 1984 207 p refs
(Contract W-7405-eng-26)
(DE84-006683; ORNL/FEDC-83/8) Avail: NTIS HC A10/MF A01

Auxiliary RF heating of electrons before and during the current-rise phase of a large Tokamak, such as the Fusion Engineering Device (R = 4.8 m, a = 1.3 m, sigma = 1.6, B sub T = 3.62 T), is examined as a means of reducing both the initiation loop voltage and resistive flux expenditure during startup. Prior to current initiation, 1 to 1 MW of electron cyclotron resonance heating power at approx. 90 GHz is used to create a small volume of high conductivity plasma (T sub e approx. = 100 eV, n sub e approx. = 10(19) m(-3)) near the upper hybrid resonance (UHR) region. This plasma conditioning permits a small radius (a0 approx. = 0.2 to 0.4 m) current channel to be established with a relatively low initial loop voltage (less than or equal to 25 V as opposed to approx. 100 V without RF assist). During the subsequent plasma expansion and current ramp phase, a combination of RF heating (up to 5 MW) and current profile control leads to a substantial savings in volt-seconds by: (1) minimizing the resistive flux consumption; and (2) maintaining the internal flux at or near the flat profile limit. DOE

**N84-22451#** Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
**INTRODUCTION TO TANDEM MIRROR PHYSICS**
J. Kesner, M. J. Gerver, B. G. Lane, B. D. McVey, P. J. Catto, D. A. Dippolito, and J. R. Myra Sep. 1983 238 p refs Prepared in cooperation with Science Applications, Inc., Boulder, Colo.
(Contract DE-AC02-78ET-51013)
(DE84-006644; DOE/ET-51013/109; PFC/RR-83-35) Avail: NTIS HC A11/MF A01

A review of the development of mirror fusion theory from its conception some thirty years ago to the present is presented. Pertinent historic experiments and their contributions are discussed to set the stage for a detailed analysis of current experiments and the problems which remain to be solved in bringing tandem mirror magnetic confinement fusion to fruition. In particular, Chapter 3 discusses in detail the equilibrium and stability questions which must be dealt with before tandem mirror reactors become feasible, while Chapter 4 and 5 discuss some of the current machines and those under construction which help to resolve critical issues in both physics and engineering whose solutions are necessary to the commercialization of tandem mirror fusion. DOE

**N84-22452#** California Univ., Berkeley. Lawrence Berkeley Lab.
**WAVE DYNAMICS OF REGULAR AND CHAOTIC RAYS Ph.D. Thesis**
Steven William McDonald Sep. 1983 342 p refs
(Contract DE-AC03-76SF-00098)
(DE84-006061; LBL-14837) Avail: NTIS HC A15/MF A01

In order to investigate general relationships between waves and rays in chaotic systems, the eigenfunctions and spectrum of a simple model, the two-dimensional Helmholtz equation in a stadium boundary, for which the rays are ergodic was studied. Statistical measurements are performed so that the apparent randomness of the stadium modes was quantitatively contrasted with the familiar regularities observed for the modes in a circular boundary (with integrable rays). The local spatial autocorrelation of the eigenfunctions is constructed in order to indirectly test theoretical predictions for the nature of the Wigner distribution corresponding to chaotic waves. A portion of the large-eigenvalue spectrum is computed and reported in an appendix; the probability distribution of successive level spacings is analyzed and compared with theoretical predictions. The two principal conclusions are: (1) waves associated with chaotic rays may exhibit randomly situated localized regions of high intensity; (2) the Wigner function for these waves may depart significantly from being uniformly distributed over the surface of constant frequency in the ray phase space. DOE

**N84-22453#** Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
**THE BASIC EQUATIONS FOR A FOUR COMPONENT THEORY OF TURBULENT MAGNETOPLASMADYNAMICS**
H. J. Kaeppeler Apr. 1983 24 p refs
(IPF-83-3) Avail: NTIS HC A02/MF A01

Equations for the four components needed to analyze ion and electron acceleration and consecutive effects in strong electric fields and high currents in magnetoplasmas are outlined. As the time scales for the microscopic and macroscopic phenomena differ by several orders of magnitude, microeffects are treated analytically, while macroscopic flows are solved by REDUCE/FORTRAN hybrid code. Microturbulence is considered in a quasi linear approximation, while the hybrid code permits a complete nonlinear approach via a macroscopic dispersion relation.
Author (ESA)

**N84-22454#** Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.

**FAR FIELD RADIATION PATTERNS FROM OPEN ENDED OVERSIZED CIRCULAR WAVEGUIDES AND IDENTIFICATION OF MULTIMODE OUTPUTS OF GYROTRONS**
Z. X. Zhang (Academia Sinica), M. Thumm, and R. Wilhelm Jun. 1983 38 p refs
(IPF-83-5) Avail: NTIS HC A03/MF A01

The far field radiation patterns of TEmn-modes and TMmn-modes from openended circular multimode waveguides in the E-plane and H-plane are calculated. The possibility and convenience of identifying the operating mode mixture of high power gyrotrons with multimode output and analyzing the mode conversion properties of overmoded waveguide components by measuring the far field radiation pattern are studied. At certain angles radiated power is contributed only by one mode from every series of modes with the same m number. This character is very convenient for mode identification. Mode mixtures in overmoded waveguides might also be identified by directional couplers, each being prepared for the selective pick up of a particular mode. Measurements of the voltage traveling wave ratio in the waveguide by small probes can be related to the composition of the modes inside the multimode waveguide, but not at high powers. Author (ESA)

**N84-22455#** Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
**THREE-DIMENSIONAL POTENTIAL STRUCTURE ASSOCIATED WITH BIRKELAND CURRENTS**
Lars Block Nov. 1983 32 p refs Presented at AGU Chapman Conf. on Magnetospheric Currents, Irvington, Va., 4-8 Apr. 1983 Submitted for publication
(TRITA-EPP-83-09; ISSN-0348-7539) Avail: NTIS HC A03/MF A01

Three-dimensional models of the potential structure above auroral arcs with upward Birkeland currents are discussed. Particles can be injected into the structure along equipotential surfaces, from the ends of the Birkeland current sheet and sideways by an electric field component tangential to the sheet. The generator can inject particles sideways through equipotential surfaces against the electric field. These particles carry the perpendicular current, but the Birkeland currents are carried by ambient particles pushed away by the space charge generated parallel electric field. A thermoelectric generator replaces cold ambient electrons by hot gradient-drifting populations. Observed current sheet thickness is inconsistent with a uniformly distributed parallel electric field. A field concentrated in a single strong double layer is inconsistent with the observed precipitation spectrum with substantial electron fluxes with energies below the total parallel potential drop. Author (ESA)

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Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

**N84-22456#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**TWO-DIMENSIONAL IMPURITY BANDS AT SEMICONDUCTOR HETERO-STRUCTURE INTERFACES**
I. C. daCunhaLima and A. FerreiradaSilva Feb. 1984 14 p refs Submitted for publication
(INPE-2996-PRE/448) Avail: NTIS HC A02/MF A01

A previously developed theory for electronic properties of doped semiconductors, that uses a Hubbard-like Hamiltonian and takes into account the effect of disorder, is applied to the impurity bands associated with inversion layers. It is shown that the impurity bands have a considerable bandwidth for concentrations in a range of experimental findings. Author

**N84-22457*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**LIQUID CRYSTAL LIGHT VALVE STRUCTURES Patent Application**
N. John Koda, inventor (to NASA) (Hughes Aircraft Co., Culver City, Calif.) Filed 9 Jan. 1984 7 p Sponsored by NASA
(NASA-Case-MSC-20036-1; US-Patent-Appl-SN-569372) Avail: NTIS HC A02/MF A01 CSCL 20L

A liquid crystal light valve is a multilayer structure containing as one of its layers a transparent conductor or electrode film on which was deposited a photosensor layer. A commonly used material for the photosensor layer is cadmium sulfide (CdS). In accordance with the present invention, an improved photosensor layer or film for use in liquid crystal light valves is prepared by sputter depositing CdS onto an ITO substrate in an atmosphere of Argon/H2S gas while maintaining the ambient temperature for the substrate in the range of from about 130 C to about 200 C. During sputter deposition, nitrogen gas is introduced into the system as a dopant to the extent of not more than about 1% of total gaseous or plasma mixture. Following deposition of the CdS film, the film is annealed in an inert gas, such as argon, at a temperature ranging from about 300 C to about 425 C. Photosensor layers or films so prepared, and liquid crystal light valves embodying such photosensors, exhibited significantly reduced image retention times (negative memory) while retaining acceptable photosensitivity. Author

**N84-22458*#** Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
**BAND-OVERLAP METALLIZATION OF BaS, BaSe AND BaTe**
A. E. Carlsson and J. W. Wilkins [1983] 19 p refs
(Grant NAG2-159)
(NASA-CR-173396; NAS 1.26:173396) Avail: NTIS HC A02/MF A01 CSCL 20L

The insulator-metal transition volumes for BaS, BaSe, and BaTe are calculated for the first time, using the self-consistent augmented spherical wave technique. The metallized transition volumes are smaller than those corresponding to the NaCl yields CsCl structural transitions, but, 10 to 15% larger than those obtained by the Herzfeld dielectric theory. The calculated equilibrium energy gaps in the NaCl structure underestimate the measured ones by 50 to 60%. Author

**N84-22459*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**THE PHYSICS OF A SINGLE-EVENT UPSET IN INTEGRATED CIRCUITS: A REVIEW AND CRITIQUE OF ANALYTICAL MODELS FOR CHARGE COLLECTION**
Oldwig vonRoos and John Zoutendyk 15 Nov. 1983 27 p refs (Contract NAS7-100)
(NASA-CR-173471; JPL-Pub-83-79; NAS 1.26:173471) Avail: NTIS HC A03/MF A01 CSCL 20L

When an energetic particle (kinetic energy > 0.5 MeV) originating from a radioactive decay or a cosmic ray transverse the active regions of semiconductor devices used in integrated circuit (IC) chips, it leaves along its track a high density electron hole plasma. The subsequent decay of this plasma by drift and diffusion leads to charge collection at the electrodes large enough in most cases to engender a false reading, hence the name single-event upset (SEU). The problem of SEU's is particularly severe within the harsh environment of Jupiter's radiation belts and constitutes therefore a matter of concern for the Galileo mission. The physics of an SEU event is analyzed in some detail. Owing to the predominance of nonlinear space charge effects and the fact that positive (holes) and negative (electrons) charges must be treated on an equal footing, analytical models for the ionized-charge collection and their corresponding currents as a function of time prove to be inadequate even in the simplest case of uniformly doped, abrupt p-n junctions in a one-dimensional geometry. The necessity for full-fledged computer simulation of the pertinent equations governing the electron-hole plasma therefore becomes imperative. Author

**N84-22460*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**CHARACTERIZATION OF GRAIN BOUNDARIES IN SILICON**

L. J. Cheng, C. M. Shyu, K. M. Stika, T. Daud, and G. T. Crotty 15 Nov. 1983 50 p refs Sponsored in part by DOE
(Contract DE-AI01-76ET-20356)
(NASA-CR-173459; DOE/JPL-1012/90; JPL-5101-233; JPL-Pub-83-87; NAS 1.26:173459) Avail: NTIS HC A03/MF A01 CSCL 20L

Zero-bias conductance and capacitance measurements at various temperatures were used to study trapped charges and potential barrier height at the boundaries. Deep-level transient spectroscopy (DLTS) was applied to measure the density of states at the boundary. A study of photoconductivity of grain boundaries in p-type silicon demonstrated the applicability of the technique in the measurement of minority carrier recombination velocity at the grain boundary. Enhanced diffusion of phosphorus at grain boundaries in three cast polycrystalline photovoltaic materials was studied. Enhancements for the three were the same, indicating that the properties of boundaries are similar, although grown by different techniques. Grain boundaries capable of enhancing the diffusion were found always to have strong recombination activities; the phenomena could be related to dangling bonds at the boundaries. Evidence that incoherent second-order twins of (111)/(115) type are diffusion-active is presented. A.R.H.

**N84-22461#** Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.
**MOMENTUM DEPENDENT LINE SHAPES IN PHOTOEMISSION Technical Interim Report**
R. A. DiDio, E. W. Plummer, and W. R. Graham 17 Jan. 1984 15 p
(Contract N00014-79-C-0991)
(AD-A137968; TR-22) Avail: NTIS HC A02/MF A01 CSCL 20/2

The crystal-momentum dependence of the line shapes appearing in photo-excitation from the valence levels of ordered S on Fe(100) has been measured using angle resolved photoelectron spectroscopy. The variation in line shape with k is a consequence of the hybridization of the energy bands of the 2-D overlayer with the 3-D solid. This observation, predicted theoretically by Liebsch, yields detailed information about the bonding interactions of ordered chemisorption systems. Author (GRA)

**N84-22462#** Wisconsin Univ., Madison. Mathematics Research Center.
**NUMERICAL METHODS FOR TRANSIENT SEMICONDUCTOR DEVICE MODELLING Technical Summary Report**
Christian Rinc.hofer Dec. 1983 39 p
(Contract DAAG29-80-C-0041)
(AD-A137970; MRC-TSR-2606) Avail: NTIS HC A03/MF A01 CSCL 12/1

A mixed system of parabolic and elliptic partial differential equations is used to describe the carrier transport and potential distribution in semi-conductor devices such as MOSFETs, diodes, etc. A singular perturbation analysis of the corresponding initial boundary value problem is carried out. Asymptotic expansions of the solution in powers of the minimal Debeye length are given. Based on this analysis a finite difference method for the numerical solution of these problems is developed. Here problems arise due to different time scales which are intrinsically present in the analytical problem. These different time scales do not occur in the physical solutions because of special (equilibrium-) initial conditions. Nevertheless they cause severe stability problems for finite difference methods. An unconditionally stable scheme is developed which minimizes computational effort. Numerical experiments on a test problem in one space dimension are presented. Author (GRA)

**N84-22463#** Rome Air Development Center, Griffiss AFB, N.Y.
**DISLOCATIONS IN SYTON POLISHED InP Report, for Aug. 1981 - Aug. 1982**
Joseph. J. Comer Aug. 1983 16 p
(AF Proj. 2306)
(AD-A138041; RADC-TR-83-178) Avail: NTIS HC A02/MF A01 CSCL 20/2

This report is about the effect of Syton polishing on single crystal wafers of InP. Whether the material is intended for device fabrication by ion implantation methods or as a substrate for epitaxial growth, it is important that the surface be smooth and clean, and that the region of the material near the surface be free of dislocations. In this case, the orientation of interest was the (111). Since InP has the sphalerite structure, one of its (111) faces will be terminated by In atoms, and the opposite by P atoms. Although chemical polishing with bromine/methanol solutions can be done on the (111)P surface, the method will not give good results on the (111) In surface. To overcome this problem, Syton polishing was attempted an opposite (111) surfaces. Using a bromine/methanol solution, it was relatively easy to thin samples by jet etching (111)P surface so that the (111) in surface could be examined. But it was difficult to etch the (111) In surface to obtain specimens for examination of the (111)P region. Nevertheless, satisfactory specimens were obtained and the results show interesting differences in dislocations at opposite (111) faces. The nature of these dislocations is described in this report. GRA

**N84-22464#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**ELECTRICAL, LUMINESCENCE AND SIMS (SECONDARY ION MASS SPECTROSCOPY) CHARACTERIZATION OF CARBON IMPLANTED VAPOR PHASE EPITAXIAL GALLIUM ARSENIDE Ph.D. Thesis**
R. M. Sydenstricker Dec. 1983 273 p
(AD-A138094; AFIT/DS/PH/83-4) Avail: NTIS HC A12/MF A01 CSCL 20/12

The electrical, luminescence and mass distribution properties of carbon implanted VPE GaAs have been analyzed. Room temperature Hall measurements and low temperature photoluminescence, each combined with chemical etching, and SIMS experiments were performed on VPE GaAs which had been implanted with 120 keV carbon atoms in doses ranging from 1 x 10 to the 13th power/sq. cm. to 1 x 10 to the 15th power/sq. cm. These samples were subsequently encapsulated with chemical vapor deposition Si3N4 and annealed at 850 C to 950 C for 15 minutes in flowing H2. Unimplanted and neon implanted control samples were also analyzed. The electrical and photoluminescence etch data independently identify a saturation effect for substitutional carbon acceptors at a concentration of approximately 3 x 10 to the 17th power/cc. The overall conclusion is that for carbon concentrations above approximately 3 x 10 to the 17th power/cc the excess carbon will not go substitutional and that for carbon concentrations less than 3 x 10 to the 17th power/cc, the carbon will reside predominately on As sites as an acceptor. Thus, despite the fact that carbon is a Group IVA impurity in GaAs, it is not likely to demonstrate amphoteric behavior as have other Group IVA dopants. GRA

**N84-22465#** California Inst. of Tech., Pasadena.
**SUPERLATTICES AND SEMICONDUCTOR/SEMICONDUCTOR INTERFACES Final Report, 1 Jun. 1980 - 31 Jul. 1983**
T. C. McGill 17 Jan. 1984 130 p
(Contract DAAG29-80-C-0103)
(AD-A138149; ARO-17257.6-EL) Avail: NTIS HC A07/MF A01 CSCL 20/12

We report on experimental and theoretical studies of the properties of superlattices and small structures. The major results include: the properties of HgTe-CdTe superlattices for IR detectors, transport over GaAlAs barriers, doping in small superlattices, new method of treating superlattices and deep levels in CdTe.
Author (GRA)

**N84-22466#** Texas Instruments, Inc., Dallas. Central Research Lab.
**GaAs/GaAlAs BIPOLAR HETEROJUNCTION GATE ARRAY Interim Report, 1 Feb. 1982 - 31 Jan. 1983**
H. T. Yuan, W. V. McLevige, F. H. Doerbeck, and B. W. Cheney 9 Sep. 1983 46 p
(Contract N00014-82-C-0212; ARPA Order 4427)
(AD-A138203; TI-08-84-08) Avail: NTIS HC A03/MF A01 CSCL 09/1

Several technological issues related to the development of GaAs bipolar heterojunction gate arrays were investigated experimentally using a test bar design that consists of discrete transistors, three types of HI2L gates, and a prototype gate array with 114 internal gates and 25 I/O buffers. The preparation of submicrometer epitaxial films composed of AlGaAS and GaAs layers required for this development were also examined. Two methods of growing epitaxial films, OMCVD and MBE, were evaluated. It was concluded that although MBE is a slow process it is superior to OMCVD in providing uniform epitaxial films with controlled doping concentrations over large area wafers. GRA

**N84-22467#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
**CALCULATIONS OF MISFIT DISLOCATION AND DANGLING BOND DENSITIES IN ABRUPT Hg SUB (1-X) Cd SUB X Te HETEROJUNCTIONS**
R. B. Schoolar 15 Dec. 1983 10 p
(Contract F04701-83-C-0084)
(AD-A138241; TR-0084(4945-07)-1; SD-TR-83-88) Avail: NTIS HC A02/MF A01 CSCL 20/12

Based on the classical theory of epitaxial crystal growth, the misfit dislocations and dangling bond densities of abrupt (111) Hg sub (1-x) Cd sub x Te heterojunctions have been calculated. For the case where (x sub 1-x sub 2) greater than 0.1 the dangling bond density is on the order of 10 to the 11th power/sq. cm. Such large dangling bond densities may produce high interface recombination velocities or band-bending at the interface. Author (GRA)

**N84-22468#** Rockwell International Science Center, Thousand Oaks, Calif. Science Center.
**PRODUCIBLE ALTERNATIVE TO CdTe FOR EPITAXY (PACE-2) OF LWIR HgCdTe Semiannual Technical Report, 1 Aug. - 31 Dec. 1983**
E. R. Gertner Jan. 1984 40 p
(Contract MDA903-83-C-0379; DARPA Order 3704)
(AD-A138255; SC5373.2SA; SATR-1) Avail: NTIS HC A03/MF A01 CSCL 20/2

This report covers the progress made toward the achievement of device quality LWIR HgCdTe on an alternate substrate. Epitaxial layers of CdTe have been grown on GaAs, Si and Ge substrates by LADA, MBE and OM-VPE. The bulk-like qualities have been found for CdTe grown on GaAs and Si. Layers of CdTe on Si lack spatial uniformity due to an extended and difficult nucleation cycle. CdTe layers grown by OM-VPE on GaAs and Ge substrates show a higher defect density than those grown by MBE or LADA. LPE HgCdTe layer growth on CdTe/GaAs, CdTe/Si and CdTe/Ge substrates resulted in chemical attack of the base substrate. Epitaxial layers of HgCdTe on these same substrates were achieved by an isothermal VPE growth technique. Author (GRA)

**N84-22469#** Rochester Univ., N. Y. Dept. of Chemistry.
**RESONANCE FLUORESCENCE OF A TWO-LEVEL ATOM NEAR A METAL SURFACE. 2: CASE OF A STRONG DRIVING FIELD**
X. Y. Huang and T. F. George Feb. 1984 24 p
(Contract N00014-80-C-0427)
(AD-A138275; AD-E950472; URochester/DC/84/TR-48) Avail: NTIS HC A02/MF A01 CSCL 07/4

The surface-dressed optical Bloch equations for a two-level atom near a metal surface are solved for the case of a strong driving field. An analytic form is obtained for the adatomic resonance fluorescence spectrum. Due to the multiphoton effects of the surface-reflected field and the surface plasmon resonance, the three-peak spectrum is strongly influenced by the surface. A unique surface-induced asymmetry in the side peaks is revealed. GRA

**N84-22470#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**THE DESIGN AND LAYOUT OF A COMPLEMENTARY METAL OXIDE SEMICONDUCTOR SILICON ON SAPPHIRE CELL LIBRARY M.S. Thesis**
W. E. Sommars Dec. 1983 266 p
(AD-A138310; AFIT/GE/EE/83D-62) Avail: NTIS HC A12/MF A01 CSCL 09/1

A method was developed for designing CMOS/SOS circuits using computer-aided design tools. CMOS/SOS fabrication methods and theory of operation as well as differences between CMOS/SOS and bulk CMOS were researched. SPICE was used to determine optimum gate width-to-length ratios resulting in symmetrical transitional delays. Two designs were developed to implement the CMOS/SOS programmable logic array (PLA), and a C program was written to automatically generate one of the designs by means of a file formatted in Caltech Intermediate Form (CIF). Basic logic gates were designed as part of a small CMOS/SOS standard cell library, and a medium scale integration (MSI) arithmetic logic unit (ALU) was developed using cells from the library. An analysis was made of significant differences between a NMOS PLA developed by Standford and the CMOS/SOS PLA. According to SPICE results, the CMOS/SOS PLA exhibited slightly faster switching speeds and greatly reduced power dissipation. CMOS/SOS circuits required significantly larger layouts than similar NMOS circuits. GRA

**N84-22471#** Oklahoma State Univ., Stillwater. Dept. of Physics.
**STUDY OF DEFECTS PRODUCED BY THE GROWTH, POST TREATMENT AND FABRICATION OF QUARTZ Final Technical Report, 15 Apr. 1980 - 30 Jun. 1983**
L. E. Halliburton, J. J. Martin, and W. A. Sibley Griffiss AFB, N.Y. RADC Oct. 1983 128 p
(Contract F19628-80-C-0067; AF Proj. 2306)
(AD-A138327; RADC-TR-83-231) Avail: NTIS HC A07/MF A01 CSCL 20/2

In order to better understand the electrodiffusion process, we have systematically investigated various aspects of sweeping. Current versus time curves show an initial decay followed by a steady current. We believe that this steady current represents the migration of only one species of ion through the crystal. Once this steady state is reached, the temperature is slowly lowered and the ionic conductivity is measured versus temperature to obtain the activation energy. Alkalis show activation energies between .76 and 1.24 eV, while hydrogen shows an activation energy of 1.5 to 1.9 eV. Low temperature IR absorption spectra, ESR spectra, and acoustic loss measurements were used to characterize the effects on the point defects of alkali and hydrogen electrodiffusion. Four point bend fracture tests were carried out on a series of At cut samples as a function of etching and hydrogen sweeping. Etched samples from hydrogen swept bars showed a greater fracture strength (i.e, were more difficult to fracture) than etched samples from similar unswept bars. GRA

**N84-22472#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
**CHEMICAL DEPOSITION OF SiO2 ON InP**
P. A. Bertrand and P. D. Fleischauer 12 Dec. 1983 21 p
(Contract F04701-83-C-0084)
(AD-A138355; TR-0084(4945-06)-1; SD-TR-83-94) Avail: NTIS HC A02/MF A01 CSCL 20/12

Chemical deposition experiments were performed to determine how surface preparation and film deposition conditions influence insulator-semiconductor interface composition and chemical structure. Silicon dioxide layers were chemically deposited on indium phosphide by hydrolyzing silicon orthopropoxide. On unoxidized, etched surfaces, coverage was always patchy. On InP with approximately one monolayer of chemisorbed oxygen in a hydrated-phosphate-like environment, a continuous, approx. 60-A-thick SiO2 film was formed at room temperature. SiO2 attached to the substrate through about one monolayer of Si-O-P bonds. Heating to 50 C during hydrolysis resulted in a mixed Si-In-P oxide, owing to simultaneous hydrolysis and oxidation processes. Author (GRA)

**N84-22473#** Rochester Univ., N. Y. Dept. of Chemistry.
**NEGATIVE-ION FORMATION FROM SURFACE SCATTERING AND THE ANDERSON CORRELATION ENERGY U Technical Report**
K. S. Lam, K. C. Liu, and T. F. George Feb. 1984 22 p
(Contract N00014-80-C-0472)
(AD-A138390; UROCHESTER/DC/84/TR-49) Avail: NTIS HC A02/MF A01 CSCL 07/4

A theoretical investigation of negative-ion formation form positive-ion-surface scattering is presented from a unified point of view. Based on the time-dependent Anderson-Newns model, the correlation energy U is seen to play an important role in the two-electron transfer process. Calculations of the probability of negative-ion formation are in good agreement with experiments on the conversion of H(+)(D(+) to H(-)(D(-) by scattering from a cesiated W(100)surface. Author (GRA)

**N84-22474#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**MEASURING THE TEMPERATURE COEFFICIENTS OF THE ELASTIC CONSTANTS OF INDIUM PHOSPHIDE M.S. Thesis**
J. K. Poe Dec. 1983 116 p
(AD-A138454; AFIT/GE/EE/83D-59) Avail: NTIS HC A06/MF A01 CSCL 09/1

The InP technique in this research applies the vibrational theory of small plates developed in order to detect acoustic resonances in single crystal InP. The change in the resonant frequencies allows calculation of the acoustic wave velocity and corresponding effective elastic constant. By measuring the effective elastic constant for various plate orientations, the elastic constants of InP can be derived. Since InP is a cubic crystal with a zinc-blended structure, measurements of the planes are sufficient to compute the elastic constants at a particular temperature. From such computations, changes in the elastic constants can be calculated with respect to temperature. Thus the temperature dependencies for the elastic constants of InP are derived. The circuitry incorporating this InP technique utilizes a spectrum analyzer, an FM dc coupled signal generator, a high precision frequency counter, and a Wayne-Kerr Bridge. In addition, an analog feedback loop was constructed to allow precision within 1 ppm. Such circuitry could easily be modified for automated data processing and high precision. This technique and resulting circuitry could be applicable to measuring acoustic properties on any piezoelectrically excitable material as demonstrated by success on X-cut quartz and InP in this research. GRA

**N84-22475#** Daresbury Nuclear Physics Lab. (England).
**TOPOGRAPHIC EXAFS**
D. K. Bowen, S. R. Stock, S. T. Davies, E. Pantos, and H. K. Birnbaum Nov. 1983 14 p
(Contract N00014-83-K-0468)
(AD-A137116; DL/SCI/P399E) Avail: NTIS HC A02/MF A01 CSCL 20/2

Contrast near an absorption edge has been observed in synchrotron radiation topographs obtained with white radiation due to the variation of wavelength across an image. Variations in absorption, due to the fluctuations in the EXAFS spectrum, appear as fringes parallel to the edge. The contrast has been measured densitometrically for a Nb specimen and excellent agreement obtained with a conventional EXAFS spectrum. The exposure time for the topograph was 25 s. The spectral characteristics of this technique are analzyed and shown to be comparable with standard EXAFS spectroscopy. The method provides a means of extracting microstructural and spectroscopic information simultaneously and point-by-point on one sample. Possible applications are discussed. GRA

**N84-22476#** California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
**FIELD GENERATED WITHIN THE SSC MAGNETS DUE TO PERSISTENT CURRENTS IN THE SUPERCONDUCTOR**
M. A. Green Jan. 1984 9 p refs Presented at the Workshop on Accelerator Phys. Issues for Superconducting Super Collider, Ann Arbor, Mich., 12 Dec. 1983 Submitted for publication
(Contract DE-AC03-76SF-00098)
(DE84-006629; LBL-17249; CONF-831264-6) Avail: NTIS HC A02/MF A01

Computer studies of the magnetic fields generated by persistent circulating currents in the superconductor of superconducting dipoles are reported. These magnetic fields are referred to as residual fields. Since the field generated by persistent currents have a hysteric behavior, they are analagous to the residual field found in iron bound conventional solenoids. The residual field calculations presented were done using the LBL SCMAG4 computer code still not well tested against measured data. A comparison with measured CBA data given suggests that good agreement is possible. The residual fields generated by persistent superconducting currents are rich in higher multipoles. This is of concern to the accelerator designer for SSC. The effect of various superconductor parameters and coil parameters on the magnitude and structure of the residual fields as well as the effect of the magnet charging history on residual fields are discussed. DOE

**N84-22477#** Arizona Univ., Tucson. Department of Physics.
**STRUCTURAL AND ELECTRONIC PROPERTIES OF ARTIFICIAL METALLIC SUPERLATTICES**
Charles M. Falco 1983 10 p refs Presented at the Intern. Conf. on the Dyn. of Interfaces, Lille, 12-16 Sep. 1983
(Contract DE-AC02-83ER-45025)
(DE84-002771; DOE/ER-45025/1; CONF-8309193-1) Avail: NTIS HC A02/MF A01

Recent progress in thin film deposition techniques has motivated renewed interest in artificially prepared metallic superlattices, exhibiting different physical properties than those in naturally occurring materials. The sputtering technique used to prepare these metallic superlattices, as well as considerations affecting their purity, interfacial quality and crystallographic orientation are described. The contribution of the interfaces to the electronic transport properties is described in terms of finite size effect theories. DOE

**N84-22478#** Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.
**THEORETICAL AND EXPERIMENTAL STUDY OF SOLID PHASE MISCIBILITY GAPS IN 3/4 QUATERNARY ALLOYS Progress Report**
G. B. Stringfellow 1 Nov. 1983 52 p refs
(Contract DE-AT03-81ER-10934)
(DE84-004391; DOE/ER-10934/T1) Avail: NTIS HC A04/MF A01

Some GaAs(1-x)Sb(x) alloys were grown at 600 C and 630 C in the middle of the solid immiscibility range, using the organometallic vapor phase epitaxial growth technique. The surface morphology is excellent, and the photoluminescence spectra are typical of the 3/5 alloy semiconductors. DOE

**N84-22479#** Los Alamos Scientific Lab., N. Mex.
**ANALYSIS OF ANELASTIC RELAXATIONS CONTROLLED BY A SPECTRUM OF RELAXATION TIMES**
J. R. Cost 1983 26 p refs Presented at the Diffusion Symp., Philadelphia, 4-5 Oct. 1983
(Contract W-7405-eng-36)
(DE84-006014; LA-UR-84-138; CONF-8310169-2) Avail: NTIS HC A03/MF A01

Anelastic studies, although providing an important method for investigating the mobility of point defects in solids, often were difficult to analyze when a continuous spectra of relaxation times controls the anelastic response. A new method for obtaining accurate estimates of relaxation time spectra by direct analysis (without prior assumptions) of the data using a nonlinear regression method are described. Applications to internal friction and anelastic creep results are described with emphasis upon the internal friction technique. DOE

**N84-22480#** California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
**HIGH RESOLUTION TEM STUDIES OF DEFECTS NEAR SI-SIO/ SUB 2 INTERFACE**
J. H. Mazur and J. Washburn Nov. 1983 13 p refs Presented at the Mater. Res. Soc. Ann. Meeting, Boston, 14-17 Nov. 1983
(Contract DE-AC03-76SF-00098)
(DE84-006562; LBL-17114; CONF-831174-75) Avail: NTIS HC A02/MF A01

Small defects with habit parallel to [100] and [311] matrix planes were observed using high resolution transmission electron microscopy (HREM) with 100 nm from the Si-SiO2 interface after one step oxidation in dry O2 at 900 C, 100 C and 1150 C of Czochralski (CZ) grown [100] p-type boron doped, 1.5 to 20 (UC OMEGA) cm Si wafers with concentrations of oxygen 1.4 x 10(18)cm(-3) and carbon 4. to 10. x 10(16)cm(-3). The defects were less than 10 nm wide and 1 nm thick. The [100] and [311] defect are interpreted tentatively as thin silica plateletes and [311] stacking faults respectively. Distribution of defects near the interface was random although their density appeared to be lower for higher oxidation temperatures. It is not yet clear whether the defects were formed during the oxidation treatments or were present near the surfaces of the as-received wafers. DOE

**N84-22481#** Argonne National Lab., Ill. Materials Science and Technology Div.
**MOLECULAR DYNAMICS STUDIES OF STRUCTURAL TRANSFORMATION IN SOLIDS**
Aneesur Rahman Dec. 1983 16 p refs Presented at the INDO-US Workshop on Diffusion in Solids, Bombay, 9-13 Jan. 1984
(Contract W-31-109-eng-38)
(DE84-006409; CONF-840145-1) Avail: NTIS HC A02/MF A01

For the study of solids it is necessary that one be able to apply not only hydrostatic pressure (i.e., an isotropic stress), but also a general anisotropic stress. The essential features are reviewed of a method which allows the parallel piped cell of molecular dynamics to vary in volume and shape determined by the difference between the internal stress tensor and the given external constant anisotropic stress. Applications that were made for the study of polymorphic transitions in crystals are then explained. DOE

**N84-22482#** Los Alamos Scientific Lab., N. Mex.
**LATTICE FOR A LOW-FIELD SUPERCONDUCTING SUPER COLLIDER**
David Neuffer 1983 4 p refs Presented at the Workshop on Accelerator Phys. Issues for a Superconducting Super Collider, Ann Arbor, Mich., 11-17 Dec. 1983
(Contract W-7405-eng-36)
(DE84-006022; LA-UR-84-191; CONF-831264-3) Avail: NTIS HC A02/MF A01

A simple lattice suitable for a Superconducting Super Collider (super-super) is presented. This super-super lattice is designed for storage of 20-TeV protons using bending magnets with peak fields of B = 2.1 T. The low-field value is chosen so that the present work may complement presentations of highfield lattices (5 T and 6.5 T) and so that this lattice may be used as a working tool to identify field-dependent aspects of the accelerator design. DOE

**N84-22483#** Los Alamos Scientific Lab., N. Mex.
**DIPOLE APERTURE AND SUPERCONDUCTOR REQUIREMENTS**
Stefen L. Wipf 11 Dec. 1983 5 p refs Presented at the Workshop on Accelerator Phys. Issues for a Superconducting Super Collider, Ann Arbor, Mich., 11-17 Dec. 1983
(Contract W-7405-eng-36)
(DE84-006011; LA-UR-84-96; CONF-831264-2) Avail: NTIS HC A02/MF A01

The cost of an accelerator is not proportional to the aperture. A change in aperture by a certain percentage results in an overall accelerator cost change by only a fraction of that percentage; the fraction is between 0.1 and 0.5 and is almost independent of the bending field. This estimate is obtained by analyzing the superconductor requirements as a function of aperture and by making rough estimates of the largest cost items of the accelerator such as magnets and ring tunnel. DOE

**N84-22484#** Valvo G.m.b.H., Hamburg (West Germany).
**HIGH SPEED, LOW POWER MOS TECHNOLOGIES Final Report, Feb. 1983**
Lothar Schumacher Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 62 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-83-289; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13

Polysilicon resistor test structures of suitable size for MOS device applications and resistances on the order of 100 Mohms are treated. These resistive loads were incorporated in a static RAM cell to fabricate a 16 k by 1 static RAM test vehicle in NMOS single-poly technology. The RAM offers a typical access time of 80 nsec, 110 mW operating power and 15 mW standby power. To achieve extremely low power dissipation n-well CMOS technology was investigated. Ring oscillators fabricated with this 2 micron high density CMOS technology show a 0.05 pJ/gate power-delay product at VCC = 5 V. Author (ESA)

**N84-21985*#** Arizona State Univ., Tempe.
**FUNDAMENTALS OF METAL-SEMICONDUCTOR CONTACTS**
Dieter K. Schroder *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 69-93 refs (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 20L

**N84-21991*#** Purdue Univ., Lafayette, Ind.
**EFFECTS OF PARTICLE SIZE DISTRIBUTION IN THICK FILM CONDUCTORS**
Robert W. Vest *In* JPL Proc. of the Flat-Plate Solar Array Res. Forum on Photovoltaic Metallization Systems 15 Nov. 1983 p 173-194 (For primary document see N84-21980 12-44)
Avail: NTIS HC A18/MF A01 CSCL 20L

# 77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

**N84-22485#** California Univ., San Diego, La Jolla. Inst. of Geophysics and Planetary Physics.
**[RESEARCH IN THE FIELD OF FLUID MECHANICS, WITH EMPHASIS ON NON LINEAR WAVES AND DIFFRACTION OF LINEAR WAVE] Final Report, 1 Jul. 1975 - 31 Dec. 1983**
J. W. Miles 16 Feb. 1984 6 p
(Contract N00014-76-C-0025)
(AD-A138378) Avail: NTIS HC A02/MF A01 CSCL 20/4

The titles of 50 papers reporting research are listed and subdivided into the following categories: applied mathematics, diffraction and radiation, Hamiltonian methods, Korteweg-deVries equation, nonlinear dynamics, nonlinear waves, solitary waves, stability, wave damping, and miscellaneous. GRA

**N84-22486#** Stanford Linear Accelerator Center, Calif.
**PROGRAM FOR A CONSTRUCTIVE PHYSICS**
H. Pierre Noyes (Tuebingen Univ.), Christoffer Gefwert (Suomen Akatemia), and Michael J. Manthey (New Mexico Univ.) Nov. 1983 11 p refs Presented at the 7th Congr. of Logic, Methodology and Philisophy of Sci., Salzburg, Austria, 11 Jul. 1983
(Contract DE-AC03-76SF-00515)
(DE84-005425; SU-SLAC-PUB-3259; CONF-830789-2) Avail:

NTIS HC A02/MF A01

A program for physics using as basic mathematics counting, binary arithmetic and randomness is outlined. The discretization of physics has replaced arbitrary continuum standards of time, length and mass by counting the oscillations of an atomic clock, counting the number of wavelengths between two positions and counting the number of atoms in a macroscopic mass. These digital dimensional standards can be used to specify three dimensional constants: the limiting velocity c, the unit of action h, and either a reference mass (EG m(p) or a coupling constant (eg G related to the mass scale by hc divided by (2(pi)gm(px2) approx. = 1.7 x 10(38)). An algorithmic construction which relates this connection to its specific laboratory paradigms is provided. As in constructive mathemtics in order to avoid redundancy. No complete infinities are allowed and finite algorithms for the computation of any acceptable concept are provided. The formalism is not reducible in a mathematical sense to conventional physics. To succeed, the program must lead to an alternative quantitative description of accepted laboratory and experiential phenomena.
DOE

**N84-22487#** Oxford Univ. (England). Cryogenics Lab.
**NIPROP: A COMPUTER PACKAGE FOR THE THERMODYNAMIC AND THERMOPHYSICAL PROPERTIES OF NITROGEN**
B. A. Hands Jun. 1983 52 p refs
(OUEL-1485/83) Avail: NTIS HC A04/MF A01

Computer programming using NIPROP to calculate the thermal and physical properties of nitrogen is outlined. Pressure, enthalpy, entropy, saturation, and density properties can be calculated. The Joule-Thomson coefficient, surface tension, viscosity, thermal conductivity, refractive index and dielectric constant can be derived.
Author (ESA)

# 80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

**N84-22488*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SIMULTANEOUS CABIN AND AMBIENT OZONE MEASUREMENTS ON TWO BOEING 747 AIRPLANES. VOLUME 2: JANUARY TO OCTOBER 1978**
James D. Hoideman, Leonidas C. Papathakos, Glenn J. Higgins (Control Data Corp., Minneapolis), and Gregory D. Nastrom (Control Data Corp., Minneapolis) Mar. 1984 47 p refs 2 Vol.
(Contract DOT-FA78WAI-893)
(NASA-TM-81733; E-789; NAS 1.15:81733; FAA-EE-83-7-Vol-2) Avail: NTIS HC E05/MF A01 CSCL 01C

Measurements of ozone concentrations at cruise altitudes both outside and in the cabin of a Boeing 747SP and Boeing 747-100 airliners in routine commercial service are presented in this series of reports. Plotted and tabulated data are identified by route and are arranged chronologically for each airplane. These data were taken at 5- or 10-minute intervals by automated instrumentation used in the NASA Global Atmospheric Samping Program (GASP). All GASP cabin ozone data obtained from January to early October 1978 are presented in this volume.
Author

# 81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**N84-22489#** Department of Energy, Washington, D. C. Office of Buildings Energy Research and Development.
**REPORT TO CONGRESS ON FEDERAL ENERGY CONSERVATION PROGRAMS, FISCAL YEAR 1981 Annual Report**
May 1983 12 p
(DOE/CE-0040; AR-5) Avail: NTIS HC A02/MF A01

Federal agencies reported achieving a proportional building energy reduction of about 14.2% over 1975 levels in terms of Btu per gross square foot. Through FY-1981 accumulated savings in buildings and facilities erg energy consumption was in excess of 70 MBOE's, which represents a cost avoidance in excess of $1.6 billion in 1980 dollars. Positive actions under the Energy Conservation Policy Act undertaken include mandatory standards for procurement policies and energy efficiency standards for the federal 10-year buildings. Workshops were conducted on LCC techniques, ridesharing programs and small business conservation programs. Tables and graphs show performance of federal agencies regarding energy consumption.
A.R.H.

**N84-22490#** Department of Energy, Washington, D. C. Office of Buildings Energy Research and Development.
**FEDERAL GOVERNMENT ENERGY MANAGEMENT, FISCAL YEAR 1981 Annual Report**
Jun. 1983 18 p
(DOE/CE-0043) Avail: NTIS HC A02/MF A01

The compliance of federal agencies with Executive Order 12203 and provisions of the National Energy Conservation Policy act is examined with emphasis on the management of energy in buildings and facilities and energy management in general operations. Life cycle costing, energy audits, agency building plans, retrofits, and federal 10 year buildings plan, standards, and energy performance targets are discussed as well as the administrative fleet and employee awareness. Statistics presented show that agencies are concentrating their efforts on meeting building energy reduction goals in Btu/GSF. Three agencies, USPS DOI, and NASA, reported achieving a 20% reduction in energy usage per GSF since 1975. Overall, the federal agencies reduced Btu/GSF consumption by 14.2% and achieved a 39% reduction in the use of petroleum based fuels in buildings.
A.R.H.

**N84-22491*#** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
**CHRONOLOGY OF KSC AND KSC RELATED EVENTS, 1982**
Ken Nail, Jr. (New World Services, Inc.) 1 Mar. 1984 330 p
(NASA-TM-85576; KHR-7; NAS 1.15:85576) Avail: NTIS HC A15/MF A01 CSCL 05A

The history of activities at the Kennedy Space Center in 1982 is presented as reflected in NASA News Releases and selected periodicals. Items are arranged in chronological order by date of the published sources. Actual data date of the event may be indicated in parenthesis when the article itself does not make that information explicit. Highlights of the year's activities include three launchings of the orbiter Columbia; successful launches of communications satellites using expendable vehicles; major changes in contracting; and the selection of a base operations contractor.
A.R.H.

**N84-22492#** Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
**[RESEARCH ACTIVITIES AT THE INSTITUTE FOR AEROSPACE STUDIES, 1982] Annual Report**
1982 90 p
Avail: NTIS HC A05/MF A01

Progress is reported in the following areas: aeronautics; aeroacoustics; air cushion technology; flight and ground transportation; fusion energy; industrial and architectural aerodynamics; laser resonance interactions and applications; mass spectroscopy and trace gas analysis; shock wave phenomena and turbulent combustion; sonic booms; space dynamics and control; structural mechanics and materials science; upper atmosphere; and flight research. The construction of a research vehicle simulator, a facility for studying two phase dusty gas flows, and a laboratory space simulator to determine the effect in time of thermal cycling, UV radiation, and electron bombardment of composite materials are milestones accomplished during the year's activities.
A.R.H.

**N84-22493#** Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
**FY85 TECHNICAL OBJECTIVES DOCUMENT**

David L. Flaa Dec. 1983 37 p
(AD-A137987; AFESC/ESL-TR-83-73) Avail: NTIS HC A03/MF A01 CSCL 13/2

This TOD describes the three Technical Planning Objectives developed to guide the conduct of research and development in passive defense techniques for the theater airbase, pavement studies, environmental pollution abatement and control, air mobility concepts, fire fighting equipment, and resource/energy conservation. Facilities aspects of Airbase Recovery and Rapid Runway Repair are also addressed. GRA

**N84-22494#** Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
**R AND D DECISION METHODS FOR PHOTOVOLTAIC PROGRAM PLANNING**
Byron Jackson Sep. 1983 57 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(DE84-000011; SERI/TR-214-1743) Avail: NTIS HC A04/MF A01

The basic methods available for R and D program management are reviewed and their application within the advanced photovoltaic research program at the Solar Energy Research Institute (SERI) is considered with emphasis on R and D management. The applicability of these methods in the advanced photovoltaic research program illustrates the potential of these management tools for other research programs. DOE

**N84-21500#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**AEROSPACE RESEARCH AND TECHNOLOGY IN GERMANY**
Hermann L. Jordan (DFVLR) *In its* AGARD Highlights, Mar. 1984 Mar. 1984 p 21-32 (For primary document see N84-21498 12-01) Avail: NTIS HC A04/MF A01

## 82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

**N84-22495*#** Old Dominion Univ., Norfolk, Va. Dept. of Geology.
**DEVELOPMENT AND OPERATION OF A REAL-TIME DATA ACQUISITION SYSTEM FOR THE NASA, LANGLEY RESEARCH CENTER DIFFERENTIAL ABSORPTION LIDAR Progress Report, 1 Jan. - 31 Dec. 1983**
Carolyn Butler and Earl C. Kindle Mar. 1984 64 p refs
(Contract NCC1-28)
(NASA-CR-173397; NAS 1.26:173397; GSTR-84-5) Avail: NTIS HC A04/MF A01 CSCL 05B

The capabilities of the DIAL data acquisition system (DAS) for the remote measurement of atmospheric trace gas concentrations from ground and aircraft platforms were extended through the purchase and integration of other hardware and the implementation of improved software. An operational manual for the current system is presented. Hardware and peripheral device registers are outlined only as an aid in debugging any DAS problems which may arise. A.R.H.

**N84-22496#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**AUTOMATED HIERARCHICAL TO CODASYL (CONFERENCE ON DATA SYSTEMS LANGUAGES) DATABASE INTERFACE SCHEMA TRANSLATOR M.S. Thesis**
James G. Owens 16 Dec. 1983 223 p
(AD-A138012; AFIT/GCS/EE/83D-17) Avail: NTIS HC A10/MF A01 CSCL 09/2

An interactive hierarchical to CODASYL schema translator was designed and implemented with the goal of taking a System 2000 (hierarchical) schema as input and producing an equivalent IDMS (CODASYL) schema, storage schema (DMCL), and subschema. In addition, this system is to serve as part of an entire System 2000 to IDMS database translator system. This thesis effort includes an analysis of the hierarchical and CODASYL models, an analysis of the System 2000 implementation of the hierarchical model, an analysis of the IDMS implementation of the CODASYL model, Data Flow Diagrams for the general hierarchical to CODASYL schema translator, structure charts for the System 2000 to IDMS schema translator, translator source code, and data dictionary. Author (GRA)

**N84-22497#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**THE OPERATOR MAPPING BETWEEN RELATIONAL ALGEBRA OPERATORS AND CODASYL BASED DATABASES MANAGED BY A CODASYL DBMS M.S. Thesis**
D. J. Nicely Dec. 1983 115 p
(AD-A138117; AFIT/GCS/EE/83D-15) Avail: NTIS HC A06/MF A01 CSCL 09/2

This thesis is an example of a mapping of a relational algebra query onto a network database. It consists of the requirements, definition, design and implementation of two generic COBOL programs for implementing such a mapping. The first program STOREMAP uses a batch input file to build a data dictionary, on the original network database, which defines the relations of which relational algebra queries may be made. This input file is created by the Data Base Administrator who is the most knowledgeable of the structure of the network database and the relations which would be useful to the databases' users. The second program NETTOREL uses the defined relations in the data dictionary and relational algebra queries created by a user to generate a result relations. Data to be included in a result relation is determined by the data dictionary's definition of the relations contained in an associated query and the criteria set by that query. This original effort shows that the theory for such an operator mapping is valid. Further efforts would be needed to make this implementation user friendly and therefore useful. Author (GRA)

**N84-22498#** Office of Naval Research, London (England).
**EUROPEAN SCIENTIFIC NOTES, VOLUME 38, NO. 3 Monthly Report**
Larry E. Shaffer, ed. Mar. 1984 55 p
(AD-A138163; ESN-38-3) Avail: NTIS HC A04/MF A01 CSCL 05/2

European Scientific Notes (ESN) is a monthly publication with brief articles on recent developments in European scientific research. The publication is not intended to be part of the scientific literature. The value of ESN articles to Americans is to call attention to current developments in European science and technology and to the institutions and people responsible for these efforts. ESN authors are primarily ONRL staff members. Occasionally articles are prepared by or in cooperation with staff members on the USAF European Office of Aerospace Research and Development or the US Army Research and Standardization Group. Qualified US scientists travelling in Europe may also be invited to author an ESN article. Author (GRA)

**N84-22499#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**MODIFICATION TO THE ADVANCED DEGREE REQUIREMENTS INFORMATION SYSTEM M.S. Thesis**
Gene P. Ranallo Dec. 1983 135 p
(AD-A138167; AFIT/GCS/MA/83D-7) Avail: NTIS HC A07/MF A01 CSCL 05/2

The Advanced Degree Requirements Information System (ADRIS), an interactive data retrieval system that resides on the CDC Cyber 74 computer system, was updated and enhanced. The system provides AFIT staff and faculty members information pertaining to Advanced Academic Degree job positions in the Air Force and to officers who possess advanced degrees. Changes were made to ADRIS to make it easier to use and to provide much needed enhancements. Extensive testing was performed

throughout the systems modification, and two primary users of the system were involved in evaluating the changes. The operational system was used as a basis for comparison tests to insure tally information in reports was accurate. The program library containing all source code, data files, and procedure files was restructured to make it easier to use during future system enhancements or maintenance. A system user's guide and maintenance guide were revised to reflect all changes made to the system and to provide additional information not previously documented. Author (GRA)

**N84-22500#** Army Construction Engineering Research Lab., Champaign, Ill.

**INTERACTIVE HAZARDOUS MATERIALS INFORMATION SYSTEM (HMIS): DESCRIPTION AND ASSESSMENT Final Report**

M. Messenger, R. D. Webster, C. C. Corbin, and L. Pritchard Dec. 1983 22 p

(DA Proj. 4A7-62720-A-896)

(AD-A138329; CERL-TR-N-170) Avail: NTIS HC A02/MF A01 CSCL 05/2

The Hazardous Materials Management System (HMMS) is a computerized system being developed to help Army fixed facilities identify chemical substances subject to the requirements of the Resource Conservation and Recovery Act and AR 200-1, and to provide handling information on those substances. One of the HMMS subcomponents is an interactive program to search the Defense Logistic Agency's Hazardous Materials Information System (HMIS) database. This report describes the development and use of an interactive version of HMIS and the use of this interactive system to assess the HMIS database. Assessment of the database showed that the data were incomplete, inconsistent, and sometimes incorrect. To solve this problem, users should search the database with assigned search terms so that as many records as possible on a specific compound can be retrieved. GRA

**N84-22501#** Naval Postgraduate School, Monterey, Calif.

**DIOPHANTINE INFERENCES FROM STATISTICAL AGGREGATES ON FEW-VALUED ATTRIBUTES**

N. C. Rowe Jan. 1984 13 p

(RR0-0001)

(AD-A138365; NPS52-84-003) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research on protection of statistical databases from revelation of private or sensitive information has rarely examined situations where domain-dependent structure exits for a data attribute such that only a very few independent variables can characterize it. Such circumstances can lead to Diophantine (integer-solution) equations whose solution can lead to surprising or compromising inferences on quite large data populations. In many cases the Diophantine equations are linear, allowing efficient algorithmic solution. Probabilistic models can also be used to rank solutions by reasonability, further pruning the search space. Unfortunately, it is difficult to protect against this form of data compromise, and all countermeasures have disadvantages. Author (GRA)

**N84-22502#** National Classification Management Society, Alexandria, Va.

**CLASSIFICATION MANAGEMENT. JOURNAL OF THE NATIONAL CLASSIFICATION MANAGEMENT SOCIETY, VOLUME 18, 1982**

E. J. Suto and M. Kenney 1983 160 p

(AD-A138480) Avail: NTIS HC A08/MF A01 CSCL 05/2

Contents: Information Security and Technology Transfer (and OUSD overview of Executive Order 12356 and DoD's view concerning implementation); GAO's Continuing Review of the Information Security Program; U.S. Defense Policy, Protection, and the Future; An Information Security Oversight Office Overview of Executive Order 12356 and Its Implementing Directive; Developing Effective Security Interface Techniques with Management; Communications Security and the Human Intelligence Threat; Security Education - Something To Think About; Protection of the Space Transportation System (STS); Remarks on the Ballistic Missile Defense Operations Security Program; Operations Security; Defense Investigative Service Program Update. GRA

**N84-22503#** Defense Technical Information Center, Alexandria, Va.

**DEFENSE TECHNICAL INFORMATION CENTER CATALOGING GUIDELINES**

G. B. Martens Jan. 1984 96 p Supersedes DTIC/TR-80/1 (AD-A138500; DTIC/TR-84/1; DTIC/TR-80/1) Avail: NTIS HC A05/MF A01 CSCL 05/2

The guidelines for descriptive cataloging is a procedure manual published by the Defense Technical Information Center. It outlines the cataloging information to be included in the data fields for computer input of technical documents. The text is arranged numerically, by field number, and includes Appendices A through I. Changes to the security classification fields have been added to implement DoD 5200.1-R, Information Security Program Regulation. The rules and procedures in these guidelines are an adaptation of Guidelines for Descriptive Cataloging of Government Scientific and Technical Reports, published March 1978, as AD-A050 900. Author (GRA)

**N84-22504#** California Univ., Livermore. Lawrence Livermore Lab.

**ENVIRONMENT FOR SCIENTIFIC LABORATORIES**

M. Blattner, K. Johnson, S. Skedzielewski, C. Streeter, and D. Sumikawa Jun. 1983 24 p refs

(Contract W-7405-eng-48)

(DE83-013848; UCID-19820) Avail: NTIS HC A02/MF A01

Software development is becoming increasingly more expensive. Resources already in existence must be used effectively as building blocks in the creation of new systems. An environment that is being built largely from existing software tools is described. Ideally, in an installation that has a large body of existing tools a chosen environment can be constructed by adapting software already on hand. A framework to put together software tools, a data base management system, and a user interface are described. The result is a powerful environment built with a modest staff. Ideas for an environment framework were realized in a particular environment christened Amicus in the hope it will be the programmer's friend. B.G.

**N84-22505#** California Univ., Berkeley. Lawrence Berkeley Lab. Computer Science and Mathematics Dept.

**GRAPHIC DESIGN FOR COMPUTER-BASED INFORMATION MANAGEMENT: A CASE STUDY OF SEEDIS**

Aaron Marcus Sep. 1983 18 p refs

(Contract DE-AC03-76SF-00098)

(DE84-005873; LBL-16330) Avail: NTIS HC A02/MF A01

The graphic design research, development, and implementation that the author has conducted over the last four years for a large geographic information management system called Seedis is summarized. Seedis and three different areas in which graphic design principles were applied are described. Charts, map design, interface design principles, tables, and letter spacing are discussed. DOE

**N84-22506#** Argonne National Lab., Ill.

**DESCRIPTION OF THE ACCESS DATA ACQUISITION SYSTEM**

B. A. Treichel and E. R. Koehl Sep. 1983 38 p refs

(Contract W-31-109-eng-38)

(DE84-005758; ANL-CT-83-9) Avail: NTIS HC A03/MF A01

The ACCESS data acquisition system is designed to acquire, process, and store samples of analog data produced by the Reversing Flow Test Apparatus. Data acquisition requires minimal interaction with the user, being governed primarily by trigger pulses generated in a shaft encoder coupled to a camshaft in the apparatus. A complete scan of 32 input data channels is made 18 times per camshaft revolution at speeds up to 30 revolutions per second. At higher speeds, up to the maximum apparatus speed of 50 revolutions per second, data channels are scanned 9 times per revolution. The programs for this data acquisition system are written for the Hewlett-Packard MCU 2250 measurement and control

processor, operating in conjunction with an HP-1000 system computer. DOE

**N84-22507#** California Univ., Livermore. Lawrence Livermore Lab.
**WANG OIS GLOSSARY PACKAGE FOR REFORMATTING DOCUMENTS TELECOMMUNICATED TO THE OIS SYSTEM**
S. R. Markow 9 Dec. 1983 27 p refs
(Contract W-7405-eng-48)
(DE84-005113; UCID-19956) Avail: NTIS HC A03/MF A01

Documents that are composed on a computer and then transmitted by telecommunications into a Wang Office Information System (OIS) word processing system need to be reformatted and cleaned up before they can be used properly as word processing documents suitable for further revisions or additions. A group of glossary entries created for the Wang OIS which simplifies the job of cleaning up telecommunicated documents are described. This glossary is a semi-automated process designed to eliminate most of the tedious work needed to be performed in removing extra spaces and returns, adjusting formats, moving material, repagination, using bs or indents, and similar problems. Briefly discussed are the problems, the glossary approach to solving them, and instructions for actually using the glossary entries. DOE

**N84-22508#** INFODAS Gesellschaft fuer Systementwicklung und Informationsverbeitung m.b.H., Cologne (West Germany).
**CONCEPT OF A SECURE INFORMATION SYSTEM CONSISTING OF THE COMPONENTS OPERATING SYSTEM, DATA BASE, DIALOGUE SYSTEM, AND APPLICATIONS Final Report, Dec. 1982**
Gerhard Weck Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 93 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-DV-83-005; ISSN-0170-9011) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 19,50

An integrated management information system secure against penetration and denial of service is presented. System components and security techniques were developed. Results were applied to a portable data base system and subsystems were isolated to avoid destruction caused by malfunctioning of one subsystem. The system is operationally secure against damage by any user within the limits of the (discretionary) access rights employed, as long as the system is installed within a suitable organizational environment. Author (ESA)

**N84-22509#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
**GUIDES TO AEROSPACE RESEARCH AND DEVELOPMENT IN NATO COUNTRIES. BIBLIOGRAPHY**
H. Behrens (Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H.) Jan. 1984 11 p
(AGARD-R-718; ISBN-92-835-1465-3) Avail: NTIS HC A02/MF A01

A bibliography representing a comprehensive survey of guides to aerospace research and development in NATO Countries was compiled. It was planned to be as complete as possible; however, only publications considered to be up to date were included. Besides guides specifically dedicated to aerospace, directories on the whole spectrum of research and development, with aerospace a sub-field only, were also considered. The bibliography contains 56 citations. M.A.C.

**N84-22203*#** Technology Development Corp., Santa Clara, Calif.
**DATA ENGINEERING SYSTEMS: COMPUTERIZED MODELING AND DATA BANK CAPABILITIES FOR ENGINEERING ANALYSIS**
H. Kopp, R. Trettau, and B. Zolotar *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 181-184 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 05B

**N84-22212*#** Control Data Corp., Bloomington, Minn. Data Management Technology Center.
**CAD/CAM DATA MANAGEMENT**
Olin H. Bray *In* NASA. Langley Research Center Computer-Aided Geometry Modeling Mar. 1984 p 255-260 (For primary document see N84-22179 12-59)
Avail: NTIS HC A17/MF A01 CSCL 05B

# 83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

**N84-22510#** Yale Univ., New Haven, Conn.
**FISCAL AND MONETARY POLICY IN A GENERAL EQUILIBRIUM MODEL**
T. Bewley 27 Jan. 1984 92 p
(Contract N00014-77-C-0518; Grant NSF SES-83-42754)
(AD-A138502; FOUNDATION-DISCUSSION-690) Avail: NTIS HC A05/MF A01 CSCL 12/1

This is a theoretical study on monetary and fiscal policy in a general equilibrium model with rational expectations, with perfect markets for current goods, but with restrictions on borrowing and insurance and with a Clower constraint on payments. Fiscal actions are understood to be manipulations of taxes and subsidies. Monetary policy is understood to be the purchase and sale of government debt or control of the banking system's ability to lend. The main result of this paper, Theorem 4.1, may be misinterpreted as saying macroeconomics is easy. Here is a model in which phenomena resembling trade cycles may occur, and it is proved that policy may prevent them. Furthermore, the result is not at all surprising once one realizes that it is an analogue of the second welfare theorem. However, one should be aware that there are strong hypotheses underlying the model. These are that expectations are rational and that random changes of aggregate importance are revealed to everyone simultaneously. The latter assumption, of course, precludes the asymmetric information which underlies the so-called island models of macroeconomic theory. GRA

# 84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

**N84-22511#** General Accounting Office, Washington, D. C.
**PROGRESS IN IMPROVING PROGRAM AND BUDGET INFORMATION FOR CONGRESSIONAL USE Annual Report**
8 Nov. 1983 13 p
(AD-A137491; GAO/OACG-84-2) Avail: NTIS HC A02/MF A01 CSCL 05/1

The annual report, submitted to the Congress in accordance with 31 U.S.C. 1113(e), summarizes progress in improving program and budget information for congressional use. The report discusses progress in such areas as cooperative work with DOD to improve their budget process; required information services provided by GAO; and continuing improvements by the executive branch. The report also discusses GAO's work on an improved financial management system for the Federal Government. Author (GRA)

# 85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

**N84-22512*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**OVERVIEW OF NASA LEWIS RESEARCH CENTER FREE-PISTON STIRLING ENGINE ACTIVITIES**

Jack G. Slaby 1984 22 p refs Proposed for presentation at the 19th Intersociety Energy Conversion Eng. Conf., 19-24 Aug. 1984; sponsored by ANS, ASME, SAE, AIAA, IEEE, ACS and AIChE

(Contract DE-AI05-82OR-1005)

(NASA-TM-83649; DOE/NASA-1005/2; E-2094; NAS 1.15:83649) Avail: NTIS HC A02/MF A01 CSCL 13I

A generic free-piston Stirling technology project is being conducted to develop technologies generic to both space power and terrestrial heat pump applications in a cooperative, cost-shared effort. The generic technology effort includes extensive parametric testing of a 1 kW free-piston Stirling engine (RE-1000), development of a free-piston Stirling performance computer code, design and fabrication under contract of a hydraulic output modification for RE-1000 engine tests, and a 1000-hour endurance test, under contract, of a 3 kWe free-piston Stirling/alternator engine. A newly initiated space power technology feasibility demonstration effort addresses the capability of scaling a free-piston Stirling/alternator system to about 25 kWe; developing thermodynamic cycle efficiency > or equal to 70 percent of Carnot at temperature ratios in the order of 1.5 to 2.0; achieving a power conversion unit specific weight of 6 kg/kWe; operating with noncontacting gas bearings; and dynamically balancing the system. Planned engine and component design and test efforts are described. A.R.H.

**N84-22513#** Science Applications, Inc., McLean, Va.

**ACTIVE PROGRAM RESEARCH REQUIREMENTS (APRR), VOLUME 1 Final Report**

W. B. Scholten and J. H. Morehouse 31 Oct. 1983 137 p

(Contract DE-AC03-81SF-11573)

(DE84-002141; DOE/SF-11573/T1-Vol-1) Avail: NTIS HC A07/MF A01

With the advent of tightened solar energy development budgets, DOE's Active Solar Program saw the need for an examination of its projects, with a focus on identifying long-term, high-risk research and development activities. The Active Program Research Requirements (APRR) project was initiated to provide the methodology adopted for examining DOE's projects to identify long term, high risk R&D activities. The results of applying that methodology to the initial set of year 2000 systems are presented. The process and assumptions used in determining cost goals and the ranking procedure are discussed. The raw results are analyzed in terms of system/subsystem requirement, the component plans, and the ranking of the projects. DOE

**N84-22514#** Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.

**EPA (ENVIRONMENTAL PROTECTION AGENCY) EVALUATION OF THE GYROSCOPIC WHEEL COVER DEVICE UNDER SECTION 511 OF THE MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT**

S. L. Syria Jun. 1983 61 p refs

(PB84-143577; EPA-AA-TEB-511-83-11) Avail: NTIS HC A04/MF A01 CSCL 13F

The conclusions of the Environmental Protection Agency (EPA) evaluation of the Gyroscopic Wheel Cover under the provisions of Section 511 of the Motor Vehicle Information and Cost Savings Act are discussed. The device is a mechanical assembly which replaces each of the standard wheel covers on a vehicle. The device is claimed to improve fuel economy, handling, and braking characteristics, and the life of the brakes tires. GRA

# 88 SPACE SCIENCES (GENERAL)

**N84-22515*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**INFRARED EMISSION ASSOCIATED WITH CHEMICAL REACTIONS ON SHUTTLE AND SIRTF SURFACES**

David Hollenbach and A. G. G. M. Tielens Mar. 1984 32 p refs (NASA-TM-85875; A-9595; NAS 1.15:85875) Avail: NTIS HC A03/MF A01 CSCL 03A

The infrared intensities which would be observed by the Shuttle Infrared Telescope Facility (SIRTF), and which are produced by surface chemistry following atmospheric impact on SIRTF and the shuttle are estimated. Three possible sources of reactants are analyzed: (1) direct atmospheric and scattered contaminant fluxes onto the shuttle's surface; (2) direct atmospheric and scattered contaminant fluxes onto the SIRTF sunshade; and (3) scattered fluxes onto the cold SIRTF mirror. The chemical reactions are primarily initiated by the dominent flux of reactive atomic oxygen on the surfaces. Using observations of the optical glow to constrain theoretical parameters, it is estimated for source (1) that the infrared glow on the SIRTF mirror will be comparable to the zodiacal background between 1 and 10 micron wavelengths. It is speculated that oxygen reacts with the atoms and the radicals bound in the organic molecules that reside on the shuttle and the Explorer surfaces. It is concluded that for source (2) that with suitable construction, a warm sunshade will produce insignificant infrared glow. It is noted that the atomic oxygen flux on the cold SIRTF mirror (3) is insufficient to produce significant infrared glow. Infrared absorption by the ice buildup on the mirror is also small. M.G.

# 89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

**N84-22516*#** National Aeronautics and Space Administration, Washington, D. C.

**THE STAR SPLITTERS: THE HIGH ENERGY ASTRONOMY OBSERVATORIES**

Wallace H. Tucker 1984 182 p refs

(NASA-SP-466; NAS 1.21:466; LC-83-16349) Avail: NTIS MF A01; SOD HC $12.00 CSCL 03A

The nature of the high energy universe and the design of instruments to analyze stellar and galactic radiation are described in this history of the HEAO program and its scientific and technical accomplishments. Topics covered include: creative violence, stellar explosions, cosmic rays, superbubbles, stellar coronas, collapsed stars, neutron stars, degenerate dwarf stars, black holes, X-ray images of galaxies, galactic nuclei, spiral galaxies, galactic clusters, the mystery of the missing mass, and cosmic fire. A.R.H.

**N84-22517*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**THE ADVANCED X-RAY ASTROPHYSICS FACILITY. OBSERVING THE UNIVERSE IN X-RAYS**

Valerie Neal [1984] 26 p Prepared in cooperation with Smithsonian Astrophysical Observatory, Cambridge, Mass. Original contains color illustrations

(NASA-EP-199; NAS 1.19:199) Avail: NTIS MF A01; SOD HC CSCL 03A

An overview of the Advanced X ray Astronophysics Facility (AXAF) program is presented. Beginning with a brief introduction to X ray astrophysics, the AXAF observatory is described including

the onboard instrumentation and system capabilities. Possible X ray sources suitable for AXAF observation are identified and defined. M.A.C.

# 90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

**N84-22518*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DETECTION OF BUMP-ON-TAIL REDUCED ELECTRON VELOCITY DISTRIBUTIONS AT THE ELECTRON FORESHOCK BOUNDARY**
Richard J. Fitzenreiter, Alexander J. Klimas, and Jack D. Scudder Feb. 1984 16 p refs
(NASA-TM-86067; NAS 1.15:86067) Avail: NTIS HC A02/MF A01 CSCL 03B

Reduced velocity distributions are derived from three-dimensional measurements of the velocity distribution of electrons in the 7 to 500 eV range in the electron foreshock. Bump-on-tail reduced distributions are presented for the first time at the foreshock boundary consistent with Filbert and Kellogg's proposed time-of-flight mechanism for generating the electron beams. In a significant number of boundary crossings, bump-on-tail reduced distributions were found in consecutive 3 sec measurements made 9 sec apart. It is concluded that, although the beams are linearly unstable to plasma waves according to the Penrose criterion, they persist on a time scale of 3 to 15 sec. M.G.

**N84-22519*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**X-RAY SPECTRA AND TIME VARIABILITY OF ACTIVE GALACTIC NUCLEI**
Richard F. Mushotzky Feb. 1984 26 p refs Presented at the Meeting on Relativistic Astrophys., Austin, Texas, 1982, and at the IAU/COSPAR Meeting on High Energy Astrophys. and Cosmology, Rojen, Bulgaria
(NASA-TM-86071; NAS 1.15:86071) Avail: NTIS HC A02/MF A01 CSCL 03B

The X-ray spectra of broad line active galactic nuclei (AGN) of all types (Seyfert I's, NELG's, broadline radio galaxies) are well fit by a power law in the .5 to 100 keV band of man energy slope alpha = .68 + or - .15. There is, as yet, no strong evidence for time variability of this slope in a given object. The constraints that this places on simple models of the central energy source are discussed. BL Lac objects have quite different X-ray spectral properties and show pronounced X-ray spectral variability. On time scales longer than 12 hours most radio quiet AGN do not show strong, delta I/I >.5, variability. The probability of variability of these AGN seems to be inversely related to their luminosity. However characteristics timescales for variability have not been measured for many objects. This general lack of variability may imply that most AGN are well below the Eddington limit. Radio bright AGN tend to be more variable than radio quiet AGN on long, tau approx > 6 month, timescales. M.G.

**N84-22520#** Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
**SPACE RESEARCH AND COSMIC PLASMA PHYSICS**
Hannes Alfven Sep. 1983 45 p refs Presented at IUGG Meeting, Hamburg, 22 Aug. 1983
(TRITA-EPP-83-06; ISSN-0348-7539) Avail: NTIS HC A03/MF A01

The impact of data from spacecraft such as Voyager on plasma astrophysics, cosmogeny and cosmology is discussed. Astrophysical fields which must be revised are listed, including double layers, energy transfer, and critical velocity. The shortcomings of the Chapman-Cowling theory are highlighted. The development of semiempirical theories is advocated. Author (ESA)

**N84-22521#** Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
**MAGNETIC FIELD ALIGNED ELECTRIC FIELDS**
Carl-Gunne Faelthammar Oct. 1983 51 p refs Presented at Joint Workshop on Solar and Space Plasma, Hilton Head Island, S.C., 20-23 Sep. 1983 the European Space Foundation Submitted for publication
(TRITA-EPP-83-07; ISSN-0348-7539) Avail: NTIS HC A04/MF A01

Parallel electric fields in space above the aurora are discussed. Electron and ion distribution measurements outside and inside the region of the parallel electric field are reviewed. Although physical mechanisms for supporting the parallel electric fields in the magnetospheric plasma are identified, their relative importance and mutual interplay are not understood. Author (ESA)

# 91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

**N84-22522*#** Maryland Univ., College Park. Dept. of Chemistry.
**LABORATORY INFRARED STUDIES RELEVANT TO IO: A SATELLITE TO THE PLANET JUPITER Final Report, 15 Oct. 1979 - 31 Dec. 1980**
R. K. Khanna 13 Apr. 1984 8 p refs
(Grant NsG-5424)
(NASA-CR-173378; NAS 1.26:173378) Avail: NTIS HC A02/MF A01 CSCL 03B

To explain the unidentified spectral features of Io, as obtained by the Voyager infrared spectrometer experiment, the infrared absorption spectra of a number of stable sulfur and oxygen compounds was measured and compared to the Voyager data. Based on the reference absorption bands of Na2SO4 and possibly SO2, the infrared data on Io in the region 700 to 200 per cm appear to represent an emission spectrum. Given the strong evidence for an oxidized crustal environment and the presence of sodium in the Io torus, the absorption spectra of the tested materials support the probability of Na2SO4 occurrence on Io. M.A.C.

**N84-22523*#** Hawaii Univ., Honolulu. Inst. for Astronomy.
**THE PLUMES OF IO: A DETECTION OF SOLID SULFUR DIOXIDE PARTICLES**
R. R. Howell, D. P. Cruikshank, and T. T. Geballe (Groningen Rijksuniversiteit) [1984] 16 p refs
(Grant NGL-12-001-057)
(NASA-CR-175414; NAS 1.26:175414) Avail: NTIS HC A02/MF A01

Spectra of Io obtained during eclipse show a narrow deep absorption feature at 4.871 microns, the wavelength of the Nu sub 1 + Nu sub 3 band of solid SO2. The 4 micron radiation comes from volcanic hot spots at a temperature too high for the existence of solid SO2. It is concluded that the spectral feature results from SO2 particles suspended in plumes above the hot spots. The derived abundance of approximately 0.0003 gm/sq cm may imply an SO2 solid-to-gas ratio of roughly one for the Loki plume, which would in turn suggest that it is driven by the SO2 rather than by sulfur. M.A.C.

**N84-22524*#** Atmospheric and Environmental Research, Inc., Cambridge, Mass.
**OUTER SATELLITE ATMOSPHERES: THEIR EXTENDED NATURE AND PLANETARY INTERACTIONS Interim Report, Dec. 1983 - Feb. 1984**
William H. Smyth and Michael R. Combi Apr. 1984 73 p refs (Contract NASw-3387)
(NASA-CR-173395; NAS 1.26:173395) Avail: NTIS

HC A04/MF A01 CSCL 03B

Model calculations for the brightness of the sodium cloud in Region A were performed to clarify the role played by the plasma torus sink in producing the east-west intensity asymmetry observed in the sodium D-lines. It was determined that the east-west electric field, proposed by Barbosa and Kievelson (1983) and Ip and Goertz (1983) to explain the dawn-dusk asymmetry in the torus ion emissions measured by the Voyager UVS instrument, could also produce the east-west sodium intensity asymmetry discovered earlier by Bergstraih et al. (1975, 1977). Model results for the directional features of the sodium cloud are also reported. The completion of the development of the Io potassium cloud model, progress in improving the Titan hydrogen torus model, and efforts in developing our model for hydrogen cometary atmospheres are also discussed. Author

**N84-22525*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE ORBIT OF LAGEOS AND SOLAR ECLIPSES**
David Parry Rubincam and Nelson R. Weiss Mar. 1984 14 p refs Submitted for publication
(NASA-TM-86076; NAS 1.15:86076) Avail: NTIS HC A02/MF A01 CSCL 03B

An eclipse of the Sun by the Moon as seen by the Lageos satellite can affect the orbital semimajor axis at the centimeter level. The weakened radiation pressure acting on Lageos perturbs the orbit differently from that due to full sunlight. This difference amounted to less than 2 mm in the semimajor axis for 23 of the 30 eclipses Lageos experienced between launch in 1976 and the end of 1983. However, it was 17.6 mm for the eclipses on 28 March 1979 and 11.2 mm for the one on 15 December 1982. Differences such as these generate large enough along-track errors to make it worthwhile to include eclipses in complex orbit determination programs such as GEODYN which integrate the orbit. Eclipses cannot explain the presently unmolded variations in along-track acceleration which have a magnitude of about 3 x 10(-12) ms(-2). M.G.

**N84-21581#** Joint Publications Research Service, Arlington, Va.
**FIRST IMAGERY FROM VENERA-15, -16 SHOWN**
A. Pokrovskiy *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 52-55 Transl. into ENGLISH from Pravda (Moscow), 17 Nov. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

**N84-21582#** Joint Publications Research Service, Arlington, Va.
**FOURIER SPECTROMETRY RESEARCH ON VENERA-15, -16**
V. Moroz and V. Linkin *In its* USSR Rept.: Space (JPRS-USP-84-002) 16 Mar. 1984 p 56-59 Transl. into ENGLISH from Pravda (Moscow), 17 Dec. 1983 p 3 (For primary document see N84-21566 12-12)
Avail: NTIS HC A05

# 92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

**N84-22526#** National Geophysical Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NO. 470, OCTOBER 1983. PART 1: (PROMPT REPORTS), DATA FOR SEPTEMBER 1983, AUGUST 1983 AND LATE DATA**
Helen E. Coffey, ed. Oct. 1983 121 p refs
(PB84-140359; NOAA-84010401-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 03B

Topics discussed include the following: IUWDS alert periods (advance and worldwide); solar activity indices; solar flares; solar radio emission; inferred interplanetary magnetic field polarity; mean solar magnetic field; boulder geomagnetic substorm log; solar active regions; sudden ionospheric disturbances; solar radio spectral observations; cosmic ray measurements by neutron monitor; geomagnetic indices; and radio propagation indices. GRA

# 93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

# 99 GENERAL

No abstracts in this category.

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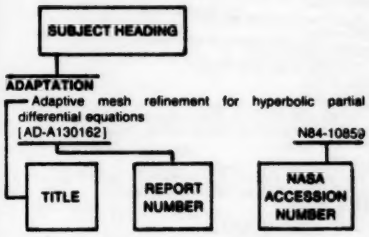


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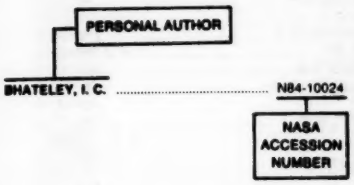


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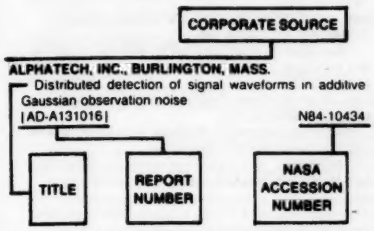


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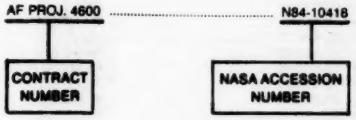


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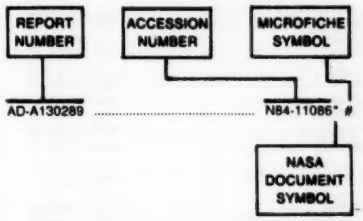


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